DREDGED MATERIAL RESEARCH PROGRAM

TECHNICAL REPORT D-78-8

USE OF DREDGED MATERIAL ISLANDS BY COLONIAL SEABIRDS AND WADING BIRDS IN TEXAS

by

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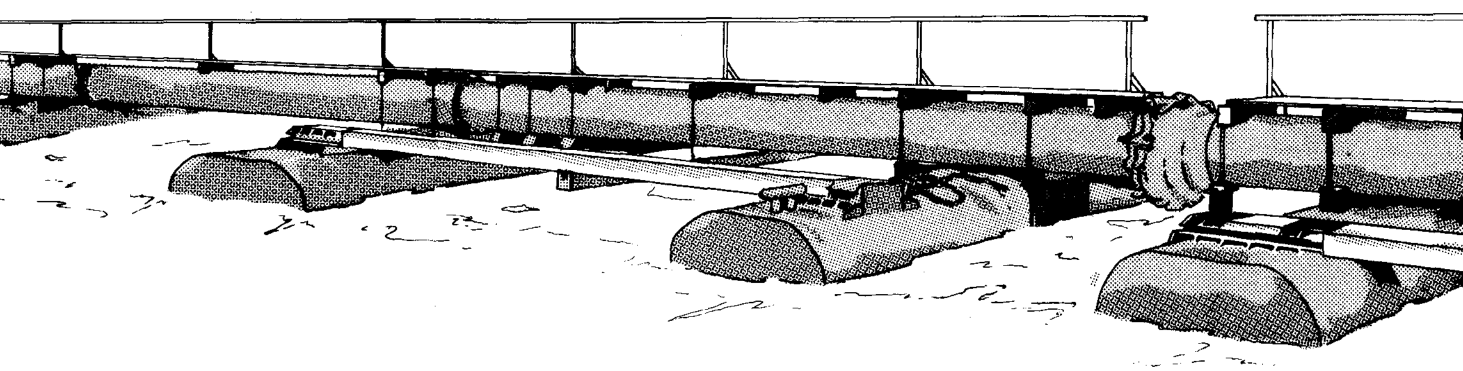

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SUBJECT: Transmittal of Technical Report D-78-8

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1. The technical report transmitted herewith represents the results of Work Unit 4F01B regarding vegetation succession and wildlife use of dredged material islands in Texas. This work unit was conducted as part of Task 4F (Island Habitat Development) of the Corps of Engineers' Dredged Material Research Program (DMRP). Task 4F was part of the Habitat Development Project of the DMRP and had as its objective the investigation, evaluation, and testing of methodologies for habitat creation and management on dredged material islands.

2. Island habitat development has been studied by the DMRP throughout the United States through the evaluation of vegetation succession and animal use of existing dredged material islands. The most significant wildlife aspect of these islands is their use by colonial nesting sea and wading birds (such as gulls, terns, egrets, herons, ibises, and pelicans). This wildlife resource, although generally inadvertently created, presents a significant opportunity for habitat management and development that is consonant with continued dredged material disposal.

3. In the study reported herein, Work Unit 4F01B, the entire Intracoastal Waterway in Texas and the Houston Ship Channel were evaluated. Of the numerous dredged material islands in Texas, 136 were surveyed, and 17 in the Galveston Bay area and 17 in the Upper Laguna Madre were selected for more detailed study. It was found that 62 percent of all colonial species (more than 156,000 adult birds) along the Texas coast in 1977 nested on dredged material islands. Five of these species, the least tern, the gull-billed tern, the roseate spoonbill, the reddish egret, and the brown pelican (endangered), are of local and national interest because of their limited numbers.

4. From a local perspective, this study will be of direct value in managing and developing dredged material island habitats in Texas. A national perspective is presented in a report entitled "Development and Management of Avian Habitat on Dredged Material Islands" (4F03), which

synthesizes island habitat research in Texas, the Great Lakes (4F01A), New Jersey (4F01D), North Carolina (4F02), Florida (4F01C), the Pacific Northwest (4F01E), and the Upper Mississippi River (4F01F).

JOHN L. CANNON
Colonel, Corps of Engineers
Commander and Director

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The disposal of dredged material resulting from the creation and maintenance of navigation waterways and harbors has become a matter of national interest and concern. Dredging operations in shallow coastal bays and estuaries have generated islands or chains of islands which have become a substrate for the development of plant and animal communities. Certain of these islands with their vegetative communities have become attractive to

(Continued)

20. ABSTRACT (Continued).

colonial seabirds and wading birds as nesting sites. The purpose of this study was to aid personnel of the U. S. Army Corps of Engineers in assessing the environmental impact of dredged material disposal sites by gathering information on those islands in Texas waters. Thirty-four islands were selected for detailed study, 17 in the Galveston-Houston area and 17 in the upper Laguna Madre near Corpus Christi. The following investigative activities were concluded: (1) the islands were photographed, visited by boat, and measured as to elevation and area; (2) over 3000 soil samples were taken; (3) the vegetation on each island was identified, measured, and quantified in over 3000 quadrats; (4) plant communities were identified and vegetation maps of each island were constructed; (5) birds using the islands as nesting sites were identified and their nests were monitored; (6) location of colonies was plotted on island maps and nesting information was summarized and placed in tabular form; (7) islands, birds, and vegetation were related to each other and discussed; (8) the numbers and species of nesting birds were compared with those nesting on natural sites in each area and for the entire Texas coast; and (9) recommendations were made concerning island construction, maintenance, and management in relation to nesting seabirds and wading birds.

PREFACE

This study was conducted as part of the Corps of Engineers Dredged Material Research Program (DMRP), Habitat Development Project, Dr. Hanley K. Smith, manager. The DMRP is sponsored by the Office, Chief of Engineers, and is assigned to the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi, under the Environmental Laboratory (EL). Director of WES during the conduct of this study was COL John L. Cannon, CE. Technical Director was Mr. F. R. Brown. Chief of EL was Dr. John Harrison. Ms. Mary C. Landin, WES, provided assistance as contract manager, and she and Dr. Robert F. Soots, Jr., WES, served as technical advisers. Technical review was provided by Ms. Landin, Dr. Soots, Dr. R. T. Huffman, Mr. C. V. Klimas, Dr. B. R. Wells, and Ms. L. Jean Hunt.

The study was funded under Contract No. DACW39-76-C-1065 with Texas A&I University at Kingsville. The study was conducted by Drs. Allan H. Chaney and Brian R. Chapman, principal investigators, with the assistance of research assistants Messrs. John P. Karges, David A. Nelson, Richard R. Schmidt, and Larry C. Thebeau.

During the study, assistance was provided by many individuals. Mr. Carlos Mendoza aided in the preparation of the proposal. Dr. Richard B. Davis provided editorial assistance. Aerial surveys conducted along the entire Texas Coast were flown by Messrs. Michael H. Moore and Gene W. Blacklock. Mr. Rodney L. Scheck constructed the maps for the report. Plant specimens were identified by Dr. George Williges. The manuscript was typed by Ms. Linda M. Scheck and Ms. Linda Gail Ivie.

The kindness and assistance of the personnel of the Padre Island National Seashore and the Corps of Engineers District Offices in Galveston and Corpus Christi are gratefully acknowledged.

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CONVERSION FACTORS, METRIC (SI) TO U. S. CUSTOMARY

UNITS OF MEASUREMENT

Metric (SI) units of measurement used in this report can be converted to U. S. customary units as follows:

Multiply	By	To Obtain
centimeters	.3937007	inches
meters	3.2808398	feet
kilometers	.62137	miles (U.S. stature)
square centimeters	.1550	square inches
square meters	10.763915	square feet
cubic meters	1.30795	cubic yards
kilograms	2.2046229	pounds
hectares	2.4709661	acres

USE OF DREDGED MATERIAL ISLANDS BY COLONIAL SEABIRDS AND WADING BIRDS IN TEXAS

PART I: INTRODUCTION

Identification of the Subject

1. The disposal of dredged material resulting from the creation and maintenance of navigation waterways and harbors has become a matter of national interest and concern. As a result of this interest and concern the Dredged Material Research Program (DMRP) was initiated at the Waterways Experiment Station (WES). One of the objectives of the DMRP was to assess the importance to wildlife of dredged material island habitats (Smith 1977).

2. Dredging operations in shallow coastal bays and estuaries often generate small islands or chains of islands and these emergent islands eventually become a substrate for the growth and development of plant and animal communities. As the islands mature, the initial communities are replaced in an orderly sequence by progressively more complex plant and animal associations. This sequence of biotic changes is known as ecosystem development (Odum 1969) or ecological succession (Odum 1971).

3. The stages, or seres, in the successional sequence vary with substrate, local hydrography, and climate. However, within a given region the patterns of seral stages may be similar with each seral stage conducive to use by certain wildlife species for feeding, roosting, and reproductive efforts. These dredged material islands can and do provide important nesting habitat for many species of colonial nesting seabirds, shorebirds, and wading birds (Pelecaniformes, Ciconiiformes, Charadriiformes, and Gruiformes) along the Atlantic and Gulf Coasts (Smith 1977).

4. In October 1976, an investigation of the use of dredged material islands by colonial nesting seabirds and wading birds in Texas was initiated. The objectives of the study were to: 1) document the use

of dredged material islands by birds on all navigable waterways in Texas that are maintained by the U. S. Army Corps of Engineers; 2) examine vegetative succession on dredged material islands; 3) identify the physical and biological features which influence the selection of certain islands as rookeries by breeding birds, and 4) provide base-line data for future studies.

5. The purpose of this study was to aid personnel of the Army Corps of Engineers in assessing the environmental impact of dredged material disposal sites in Texas waters. This information should aid in formulating standards for the placement and design of dredged material islands as well as provide recommendations for disposal of materials and management or development of habitats on existing islands.

History and Description of Dredging in Texas

6. Efforts to obtain an inland waterway system began before Texas became a Republic (Anonymous 1976). Most of the early attempts to open various Texas waterways to navigation were made by local entrepreneurs but the advent of World War I proved that a system of internally connecting waterways was needed. The Federal government began buying private canals and improving existing channels along the entire Gulf Coast and by 1925 there was a continuous government-operated waterway from the Mississippi River to the Sabine River.

7. In 1925 Congress approved the dredging of a 2.7-m* by 30.5-m canal from the Sabine River to Galveston Bay. This channel was completed in 1933 and by 1941 had been extended from Galveston to Corpus Christi.

8. In 1942 the U. S. Army Corps of Engineers (USACE) was authorized to enlarge the Gulf Intracoastal Waterway (GIWW) from Apalachee Bay, Florida to Corpus Christi and to extend the GIWW to the vicinity of the Mexican border. This enlargement would improve the channel to an authorized depth of 3.7 m and an authorized width of 38.1 m. The

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* A table of factors for converting metric (SI) units of measurement to U. S. customary units is presented on page 7.

enlargement and extension to Brownsville was completed in 1949.

9. The GIWW extends approximately 787.1 km along the Texas coast from the Sabine River to Brownsville and is heavily used. Since 1969, annual shipping tonnage has exceeded 54.5 million metric tons. Numerous tributary channels connect and many other Federally authorized shallow-draft tributary channels connect via other navigable channels. Numerous private concerns have dredged channels that may link directly with the GIWW or that unite with Federally authorized channels for access to the GIWW.

10. The construction and maintenance of a complex of navigational channels requires the dredging and disposal of thousands of cubic meters of dredged material. As a result of variable shoaling rates, maintenance dredging must be done every 12 to 60 months on portions of the channels. A total of 10,904,848 cubic meters of disposal material is dredged annually from the GIWW and its major tributary channels in Texas (USACE 1975).

11. The most commonly used method of dredging along the Texas GIWW and its tributaries is the hydraulic dredge. These dredges are not self-propelled and must be towed to the job site. They have cutterheads at the end of a long pipe fitted with a powerful suction pump. They work by loosening the material from the bottom, sucking it up as a thin slurry, and pumping the slurry through a pipeline to a disposal site (USACE 1975).

12. In Texas, there are three methods of dredged material disposal. The most recent, where feasible, is to deposit the materials in dike-enclosed land banks. For those channels that pass through deep water areas, dredged material is deposited in sub-aqueous banks; but in shallow bays or lagoons, the deposits commonly form emergent domes, or islands. Recently, dikes have been constructed on existing dredged material islands to contain additional materials from subsequent disposals.

Succession on Emergent Disposal Sites

13. Any standard introductory ecology text such as Odum (1971) or Smith (1974) presents descriptions of the principles of succession.

Therefore, the following discussion is merely a brief summary of the major aspects.

14. The assemblage of plants and animals occupying an area at any given time is termed the biotic community. The species composition of a community changes through time so that one community replaces another in a continuous series of stages called seres. Each seral stage results from the interactions of climatic, edaphic, and biotic influences with the alteration of the environment induced by the bio-dynamics of the previous stage. Theoretically, the succession reaches a stable, self-perpetuating stage known as a climax community. In most cases, however, succession is prevented from reaching a climax stage.

15. The creation of a dredged material island presents a new substrate for seral development. When dredged material is deposited, it generally forms a wide, inverted bare, dome-shaped mound. In North Carolina, drift material was deposited on dredged material islands in two ridges which were the result of storm and spring tides (Hunter and Quay 1953). The drift material, primarily of dead plant remains containing seeds, provided a bed in which seeds became established (Soots and Parnell 1975b). Soots and Parnell (1975a; 1975b) have outlined the plant succession and utilization of each seral stage by nesting birds on dredged material islands in North Carolina.

16. Detailed studies on the succession of plant and vertebrate communities on Texas dredged material islands are lacking. However, a number of studies have dealt with aspects of the successional sequence. Barnes (1971), Mendoza (1974) and Ortiz (1974) have detailed the physical features, plant associations and bird communities on a series of dredged material islands in the upper Laguna Madre. McMurray (1971), Simersky (1971) and DePue (1974) analyzed the nesting habitats of specific shorebirds or wading birds on dredged material islands in the same area.

17. There are no published reports on biotic aspects of dredged material islands elsewhere on the Texas coast. However, the Coastal Zone Resources Corporation (1977) studied the sequence of plant succession at an upland disposal site along the GIWW near High Island, Texas. The

proximity of High Island to both East Bay and Trinity Bay makes this successional study useful in an analysis of plant and animal succession on dredged material islands in this area.

PART II: METHODS AND MATERIALS

Description of the Study Area

18. The Texas coastline can be divided into four climatic regimes based roughly on rainfall (Thornthwaite 1948). A semi-arid climatic type, charactized by evaporation in excess of rainfall, extends from the Rio Grande to a point just south of Corpus Christi. The dry subhumid zone, which extends from Corpus Christi to Port Lavaca, has a moisture deficient climate that occasionally approaches a moisture balance, depending upon the frequency of hurricanes. In the moist subhumid zone from Port Lavaca to Galveston, rainfall and evaporation are in approximate balance but tending to a moisture surplus. From Galveston to the Sabine River the climate is humid.

19. The transition between the climatic zones is so gradual that Gould (1962) included the entire coastal zone of Texas in a life zone called the Gulf Prairies and Marsh vegetational area. Blair (1950) placed the coast within the Tamaulipan, Texas, and Austroriparian life zones and Tharp (1952) divided the coast into the coastal prairie, mesquite-chaparral and coastal sand dune vegetational regions. South of Corpus Christi in the semi-arid climatic zone, *Prosopis glandulosa* Torr. and chaparral have invaded the shallow sand areas of the coastal prairies. *Quercus virginia* Mill. is common in the deeper sand dune areas from Corpus Christi to Galveston and pines are prevalent east of Galveston.

20. Although the climate of the southern coastal area is subtropical to semi-arid, it is moderated by maritime tropical air out of the southeast from the Gulf of Mexico. These southeast winds are important factors in any analysis of Texas bays since they transport sands and pollen from the barrier islands to the inland bays.

21. The climate of the northern part of the coast is more temperate with temperatures influenced to a greater extent by the humidity. Air temperatures vary from 25° to $30^{\circ}C$ in the summer and 10° to $20^{\circ}C$ in the winter along the entire coast (Orton 1969). Air temperatures near

$0^{o}C$ occur almost every winter but last for only a few hours. Because of the shallow depth of the coastal bays and estuaries, water temperatures change quickly as do air temperatures.

Selection of Specific Study Areas

22. The majority of dredged material islands along the Texas coast are concentrated in the Laguna Madre and in the complex of bays around Galveston (Figure 1). These areas vary greatly in climatic and hydrographic features and this regional variation could affect patterns of plant and avian succession. Therefore, to thoroughly analyze plant succession and subsequent use of dredged material islands by colonial seabirds and wading birds along the Texas coast, detailed studies in two specific areas were completed.

23. The northern study area consisted of all of Galveston Bay including the Houston Ship Channel, Trinity Bay, East Bay and West Bay (Figures 2 and 3). The southern area for specific study included Aransas Bay, Corpus Christi Bay, Baffin Bay and that portion of the Laguna Madre from Corpus Christi Bay to 1.6 km south of Baffin Bay (Figure 4). All of the islands chosen for detailed study were located in the Laguna Madre.

Description of Specific Study Areas

Southern Study Area - The Laguna Madre

24. The Laguna Madre is a shallow lagoon that extends approximately 193.1 km south from Corpus Christi Bay to just south of Port Isabel (Figure 1). It is separated from the Gulf of Mexico by Padre Island, one of a series of barrier islands along the Texas coast. The lagoon is bisected by the GIWW for its entire length and is divided into northern and southern parts by extensive, barren sand flats formed by a hurricane in 1919 (Simmons 1957). The GIWW through these sand flats is the only permanent water connection between these two parts. The northern part of the Laguna Madre, which was the specific study area, is

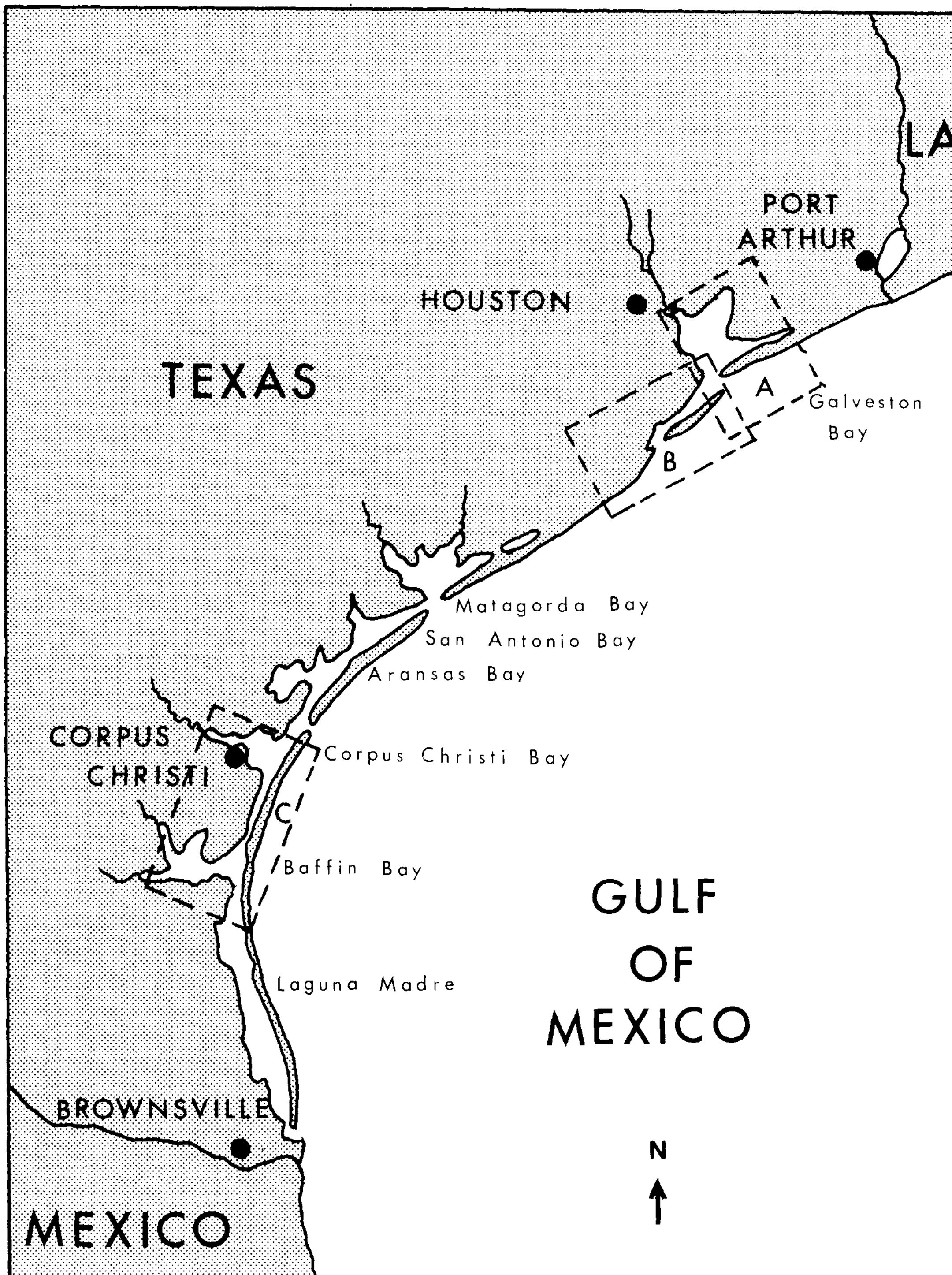


Figure 1. Map of the Texas coast with insets showing the specific study areas (A, B and C)

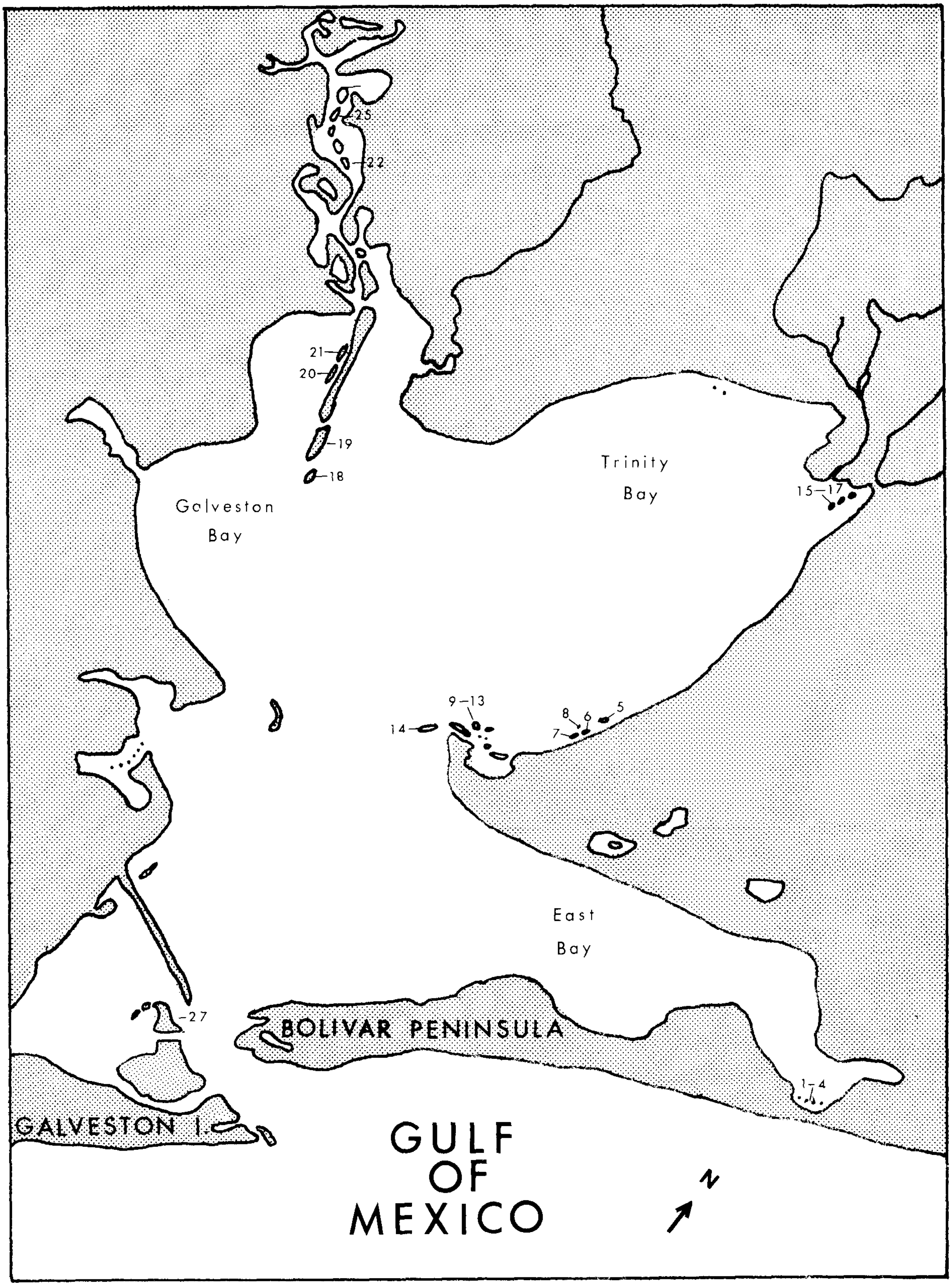


Figure 2. Inset A showing serially numbered islands photographed for the study in the Galveston Bay area.

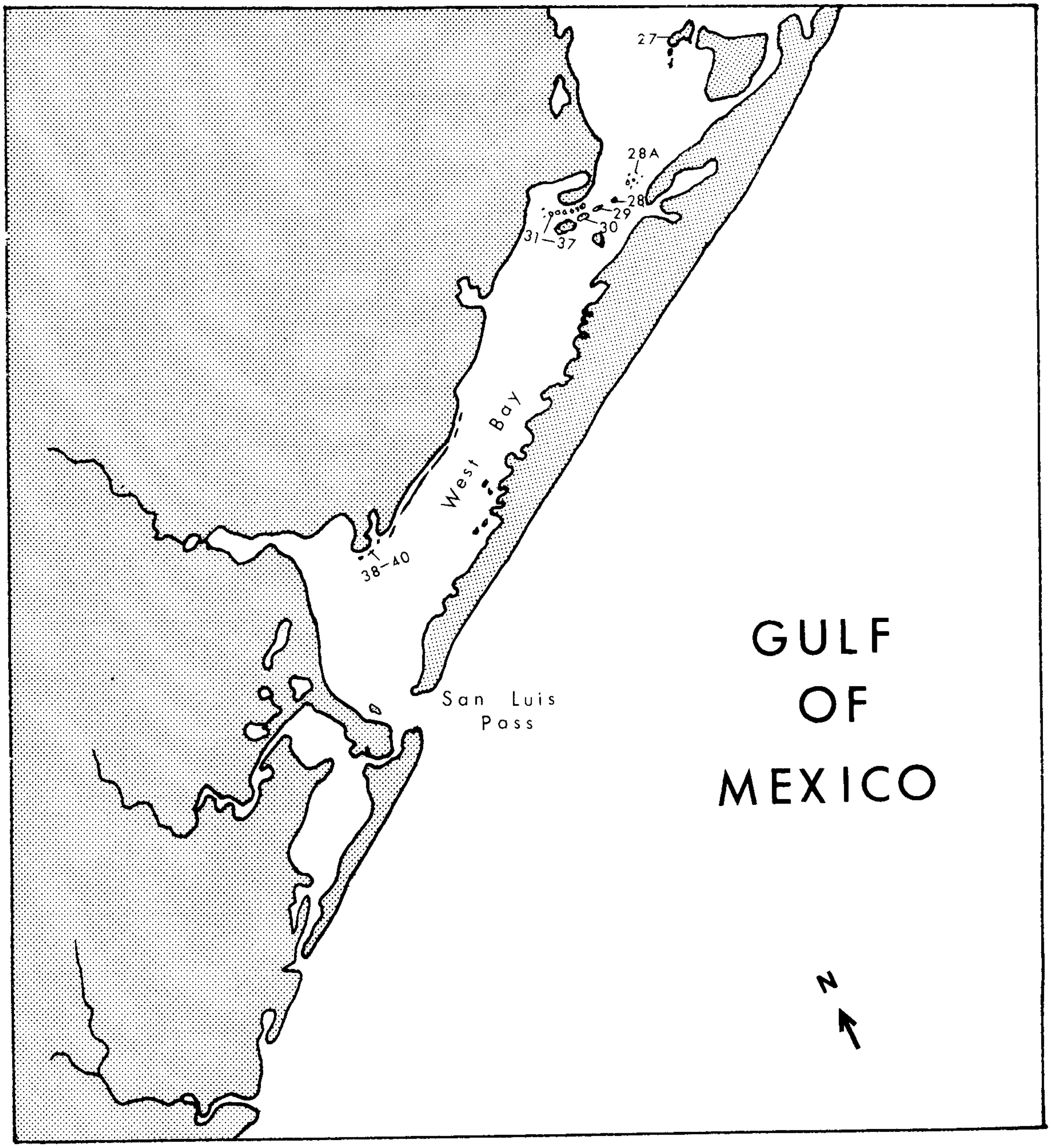


Figure 3. Inset B showing serially numbered islands photographed for the study in West Bay.

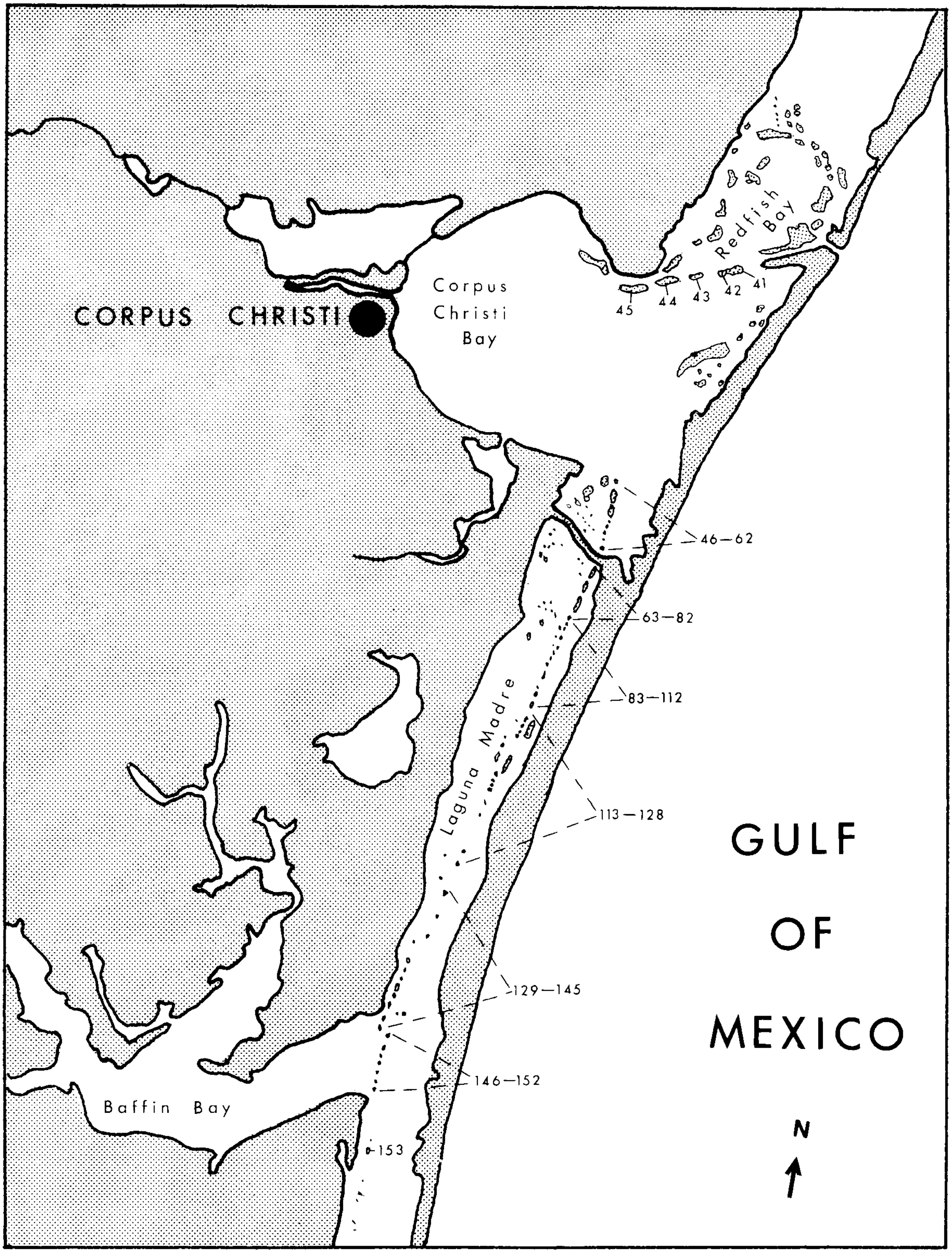


Figure 4. Inset C showing serially numbered islands photographed for the study in the Corpus Christi area.

connected to Baffin and Alazan Bays, two usually hypersaline bays that unite before entering the Laguna Madre. The lagoon is deepest at this junction, approximately 3.0 m, but rarely exceeds 1.8 m elsewhere (Breuer 1962).

25. Corpus Christi Bay, prior to 1950, was broadly connected to the Laguna Madre at its upper end and water exchange with the Gulf of Mexico was possible through the Corpus Christi Ship Channel entrance at Port Aransas. From time to time, hurricanes have opened natural passes through Padre Island and water has been exchanged with the Gulf of Mexico for short periods of time.

26. In 1950 a landfill causeway was constructed from the Encinal Peninsula (Flour Bluff) to Padre Island separating the Laguna Madre from Corpus Christi Bay and the Gulf of Mexico. Exchange of water with Corpus Christi Bay is presently limited to three openings totaling 457.2 linear meters in width at extreme high water, or approximately 274.3 linear meters at mean low tide (Simmons 1957).

27. Tidal fluctuations within the lagoon are slight, recorded as 11 to 12 cm by Fisk (1959). Strong winds are capable of reversing the direction of tidal flow (Hildebrand and King 1972-73) and increasing the effect of the tide on the windward side of land masses around and in the lagoon. Winds from the southeast or south-southeast are prevalent even during some winter months (Lohse 1955). Northerly winter winds push water into the northern part of the lagoon from Corpus Christi Bay, lower the tide in the northern end, and raise it at the southern end by as much as 30 cm (Simmons 1957). Spring and autumn high tides raise the water level by as much as 40.6 cm, but this has little effect on salinity and water quality. Tidal currents have not been completely plotted for the area (Simmons 1957), probably because of the influence of the wind.

28. There are no permanent fresh water streams that flow into the Laguna Madre. Fresh water inflow to the northern portion is by means of intermittent streams that enter Baffin Bay during periods of precipitation (Hildebrand and King 1972-73). After light showers, these streams may wash salt deposits into the bay (Simmons 1957).

29. The predominant characteristic of the Laguna Madre is its

hypersalinity, which commonly exceeds 70 ppt (Simmons 1957) and has been recorded above 100 ppt (Baker 1949, Hedgpeth 1953). However, after a heavy rain, surface salinities as low as 2 ppt have been recorded (Hedgpeth 1947). The Laguna Madre and the Laguna Madre del San Antonio (Laguna Tamaulipas) of northern Mexico are the only hypersaline lagoons in North America (Gunter 1967). High evaporation rates, limited tidal exchange and limited fresh water inflow contribute to this hypersalinity (Warshaw 1975).

30. As a result of these influences, the sediments in the Laguna Madre are different from those of the more humid bays to the north (Shepard and Rusnak 1957). The major sediment constituent is eolian sand from Padre Island, probably originating from Rio Grande River deposits on the Continental Shelf (Fisk 1959). The only clay is in the central Baffin Bay area and a small amount from the Nueces River where it empties into Corpus Christi Bay. The sand in the northern Laguna Madre is often mixed with fine shells *Mulinia lateralis* (Say) and *Anomalocardia auberiana* (Orbigny), some silts and finely crystalline calcareous and gypsum aggregates.

31. Under the hypersaline conditions, the mud flats in many parts of the Laguna Madre support luxuriant growths of a blue-green algae, *Lyngbya confervoides* (C. Hgardh) Gomont (Sorenson and Conover 1962). Three species of sea grasses, *Halodule Beaudettii* (den Hartog) den Hartog, *Ruppia maritima* L. and *Halophila Engelmanii* Asch, are common in the shallow waters (Hedgpeth 1967). The plant communities with their associated invertebrate fauna support high fish populations. Catches in the upper and lower portions of the Laguna Madre together accounted for 59 percent of the total finfish catch in major Texas bays during 1969-70 (Warshaw 1975). Lists of the nektonic vertebrates and invertebrates have been compiled by Breuer (1957; 1962), Simmons (1957) and Hildebrand and King (1972-73). Hellier (1962) examined the relationship between fish biomass and photosynthesis in the lagoon.

32. The GIWW was completed through the upper Laguna Madre in 1948 and there are now 109 dredged material islands formed by its construction and maintenance from the mouth of Corpus Christi Bay to one mile south

of Baffin Bay where the channel enters the exposed sand flat. Three islands in this area, Pita, North Bird, and South Bird, are natural islands. There are approximately 40 smaller dredged material islands located along privately maintained tributary channels.

Northern Specific Area

33. The northern specific study area consists of a complex of four bays: all of Galveston Bay including the Houston Ship Channel, Trinity Bay, East Bay and West Bay. These bays are less than 1.8 m deep over most of their area and the substrate is fine sand and smaller particles but oyster shell and oyster reefs are common. Major oyster reefs separate several of these bays (Harry 1976) and Rehkamper (1969) has mapped all of them in the bay complex.

34. Two major rivers, the Trinity and San Jacinto, enter the upper bays by way of the Houston Ship Channel. Numerous smaller streams drain more limited areas around the bays. There are three connections to the Gulf of Mexico: through Bolivar Pass at the east end of Galveston Island, San Luis Pass at the western end of West Bay and a small artificial pass at the eastern end of Galveston Bay. Tidal variations in this region average about 30 cm (Harry 1976).

35. Due to river-borne sediments, abundant phytoplankton, shallowness and wind and wave action, the bays are continually turbid to the extent that objects deeper than one foot are usually not visible. As a result, microscopic aquatic plants are rare in the region. Some isolated patches of sea grasses are found in areas of West Bay.

36. The soils of the dredged material islands in the northern specific study area are classified as Ijam soils (Crout 1976; Wheeler 1976). Included in this series are alkaline and saline soils that are deep, nearly level and clayey. These soils formed in alkaline, saline, clayey, marine and alluvial sediment that was dredged or pumped from the floor of rivers, bays or canals during the construction of canals or waterways.

37. In representative profile, the surface is dark-gray clay about 20.3 cm thick. The next layer is dark-gray and gray clay that

extends to a depth of 1.6 m. However, included in some of the dredged material deposits are soils that differ from Ijam soils in texture, color, stratification and depth of horizon. Some of these soils have stratified coarse sand and oyster shell layers and some areas have yellowish-brown lower layers.

38. The Ijam soils are poorly drained. Permeability is very low and available water capacity is moderate. Runoff and internal drainage are very slow (Crout 1976). Ijam soils are generally considered poor soils for vegetation development due to their salinity and poor surface drainage. Newly deposited Ijam soils may not support vegetation for several years (Wheeler 1976).

39. The history of channel construction is complex and will be discussed in the description of each study island. The GIWW was constructed through the area during 1938 and 1939. Some deposits along the Houston Ship Channel are 60 years old.

Island Selection

40. Within each of the two study areas, each island or other nearby locality with a history of bird nesting was located and serially numbered (Appendix A). The primary source for this information was a series of reports entitled "A cooperative census of large fish-eating birds along the Texas coast from Pass Cavallo to Penascal Point," subsequently shortened to "The cooperative fish-eating bird census." The series was begun in 1967 by Dr. Henry Hildebrand, Texas A&I University, and Mr. Gene Blacklock, Welder Wildlife Foundation. Each census, taken at the peak of the nesting period, was made from the air and supported by counts made by ground parties. After 1969 the census was carried on under the direction of Gene Blacklock, who supplied this study with most of the nesting information. Sponsoring agencies have included Welder Wildlife Foundation, Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, Padre Island National Seashore, various universities and other organizations. This information was invaluable in locating prospective study islands, and as baseline information on past

performance of each bird species along the coast of Texas.

41. All dredged material islands, some natural islands with dredged material deposited on them, and a few undisturbed natural islands with records of bird nesting were located, visited by air, named and numbered according to proximity to channel markers and/or local name. All were then photographed from the air by Wallace Aerial Company of Houston, Texas, at a scale of 2.5 cm equals 304.8 m. Islands were selected from contact prints. Most prints were enlarged to a scale of 2.5 cm equals 45.7 m and color transparencies of each were made. Because of the selection of this standard scale, most islands would fit within a 22.9 cm by 22.9 cm frame and either could be shown on an overhead projector or outlines could be transferred to standard sized paper. The photographs of the larger islands were divided into sections and printed at the same scale. In addition, the photographs of the larger islands were further reduced in size and extra prints were made at this larger scale.

42. From these scaled photographs, the size of each island was determined using a planimeter and outlines were traced for construction of maps of vegetation and specific nesting locations. The contact prints were used to up-date charts of the area and from these, maps were drawn showing the general shape, size and location of each island in the study area (Appendix B). Each of the islands was serially numbered and a data sheet with physical dimensions, date of construction, dredged material deposition history, basic vegetation and history of bird nesting was constructed (Appendixes C and D).

43. Dates of both construction and dredged material deposition to have been provided by the U.S. Army Engineer District, Galveston, field offices at Galveston and Corpus Christi were incomplete, so most of the history was obtained from examination of past aerial photos and consultation with people in the area. The photos that were examined were made for and obtained from the following agencies: Texas General Land Office, U.S. Geological Survey, U.S. Department of Agriculture, National Aeronautics and Space Administration, and Texas A&I University. Some islands within the specific study areas were photographed during certain years

between 1945 and 1976 and by using these photographs and canal maintenance schedules we were able to conclude from the appearance of outfall erosion scars and/or fresh deposits whether or not deposits had been made on some of the islands.

44. With the aid of the color transparencies, island construction dates, dredged material deposition history and bird nesting history, 17 islands were selected in each of the two areas, 34 in all. Criteria for their selection included: adequacy of historical information; variability of vegetation; soil type; shape and size of the island; age of dredged material deposition; the possibility of determination of vegetation succession; history of nesting birds; and a history of previous studies.

Vegetation Studies

45. Each island was visited during the early part of the study, the apex of each island was visually located and marked and a transect was established from the apex, usually along the greatest length of the island. Additional transects were established at 90° to the original one, also from the apex. Other transects were established, as necessary, if significant vegetation communities appeared to have been by-passed by the original transects. Modifications of this method included those established on a very large island, Little Pelican, and several other flat or sloping islands in the northern area and one double island in the southern area. On these islands enough transects were arbitrarily established so as to pass through all significant vegetation communities.

46. Along each transect, points were established at 3-m intervals in grass and herb communities, 5-m intervals in shrub communities and 10-m intervals in tree communities. At each point 1-, 2- and 4- meter-square quadrats were outlined in each community, respectively. Small trees (those 2 m and under) were classed as shrubs if they were located in a community of shrub species, otherwise they were recorded as trees and the quadrat spacing and size were adjusted accordingly. There was little difficulty in adjusting the spacing and quadrat size between

communities. The transitions were made on the basis of the major type of vegetation in adjacent quadrats. For example: if a series of quadrats along a transect were those used to survey a grass and herb community and a shrub community was encountered, the next quadrat was increased in size and the distance between it and the next quadrat was enlarged. This method was used with all communities as they were encountered along each transect. In the southern area the majority of the quadrats were those for herb and grass communities while the majority in the northern area were for shrub and tree communities. On some islands in the northern area the shrub and tree cover was so dense that paths were cut with machetes. In the southern area some quadrats were never analyzed because the act would have disturbed birds already nesting.

47. On each trip to the islands samples of the plant species found in the quadrats and those not encountered in the quadrats and uncommon on the island were collected. No measurements were taken on those uncommon plants not found in the quadrats. A list of kinds of plants and plant density (total number of stems or plants per species per quadrat) was made for each quadrat. Each plant found on each island was later placed into one of the following (frequency) categories:

- a. Uncommon, not occurring within any quadrat or in only one of all quadrats on a specific island.
- b. Infrequent, greater than 10 percent but occurring in less than 10 percent of all quadrats on a specific island.
- c. Abundant, occurring in less than 30 percent of all quadrats on a specific island.
- d. Very abundant, occurring in more than 30 percent of all quadrats on a specific island.

48. A visual estimate of the amount of cover of each plant species over the ground surface in each quadrat was made, based upon numerical groupings of <5, 5 to 25, 25 to 50, 50 to 75, and 75 to 100 percent of ground covered. In addition, each species in the quadrats was assigned to one of the following height classes: less than 0.1 m, 0.1 to 0.5 m, 0.5 to 1 m, 1 to 2 m, 2 to 3 m, 3 to 5 m, 5 to 10 m, 10 to

20 m, 20 to 35 m, and greater than 35 m.

49. The data gathered from the quadrats were used to analyze vegetational communities, to construct vegetation maps of each island and to determine the abundance of each species on each island. Much of this information is displayed in Appendix F.

50. The individual plants of each species that were collected from the quadrats and the additional species that did not appear in the quadrats were subjected to standard preservation techniques, identified by Dr. George Williges, botanist at Texas A&I University, placed in folded newspaper and labeled as to date and island from which collected. Voucher species were sent to WES for verification and storage. Others were mounted and retained as specimens in the herbaria at Texas A&I University and Corpus Christi State University. Lists were prepared of all plant species encountered on the islands in both the northern and southern areas (Appendixes D and E). The authority for scientific and common names was Correll and Johnston (1970).

51. Enlarged color transparencies were a valuable aid in the delineation of the various plant associations within the three basic communities. The margin of each island was traced onto a sheet of paper and the visible trees, isolated shrubs and plant communities were outlined. Identification of the major components within each community was made from quadrat data and the margins of each community were verified by comparing the maps with notes from visual reconnaissance on each island. In this fashion vegetation maps were constructed for each island.

Study of Soils and Substrates

52. Qualitative observations were made of soil composition, i.e. shell, rock, loam, sand, and clay, and the vertical distribution of these types during the visitations to the islands. In addition, approximately 15 cu cm of soil were collected from each quadrat on each island. These samples were taken to a depth of 15 cm with a small core sampler and labeled as to transect, quadrat number, island and date.

All were shipped to WES for analysis and future studies. Special note was made of the substrate on which ground nests were constructed.

Study of Bird Colonies

53. Bird colonies were located by several methods, the most important of which was the cooperative census of fish-eating bird data. Other colonies were discovered through aerial surveys of the coast during March, April and May. Isolated colonies of Least Terns and Black Skimmers were discovered late in the nesting season when the field crews went by boat to certain islands.

54. Several different census techniques were attempted on various colonies. Flights were made over all islands on 6-7 March, 25-26 April and 21-23 May 1977, and the number of pairs of birds were recorded. A concerted effort throughout the Texas coast was made by several teams of interested persons to count all of the pairs of birds in nesting colonies between 28 May and 12 June. The various bird species were identified. Some were counted as they were flushed from their nests, and individual nests were identified and the number of pairs determined from this nest count. The latter proved to be the more accurate figure for any one species but was difficult to obtain because of the difference in nesting time within and between species on islands where several species nested. On those islands with low vegetation and few, mostly ground nesting bird species, counts of nests were easily made by several persons walking transects across the islands and counting the various nests as they walked. This method was very effective because the counts were accurate and the birds were not disturbed for any great length of time. On those islands with dense and high vegetation, the disturbance factor was too great and either counts of flushed adults or a sample count of nests per unit area was made. Total counts were extrapolated from this sample count and the total area occupied by the bird species. The threshold for disturbance seemed to be much lower for the birds in the northern area than those in the southern one. As a result, many colony counts were made by total nest counts in the northern area.

55. On those islands with nesting colonies, all nests, if less than ten, of each species were marked and monitored. If more nests were present, at least ten were marked and checked at irregular intervals.

56. Stamped aluminum tags tied with wire to the trees and bushes in which nests occurred were used as nest markers in the southern area. Ground nests were marked with numbered, short surveying stakes or welding rods positioned near the nest, or with 1.6-m lathe stakes near those nests in high, thick vegetation. Most of the nests marked were those near the periphery of the colony because these nests could be monitored with the least disturbance to the colony.

57. Nests in the thicker, taller vegetation of the northern area were first indicated by marking adjacent limbs with various combinations of colored spray paints. These markings were quickly obliterated by the weather and numbered plastic tags were substituted. More nests of each species were marked in the northern than in the southern area because the birds did not seem to react as adversely to the presence of humans as did those in the southern area. Trails were cut into the thick vegetation to mark the more interior nests. Ground nests were marked in a fashion similar to that in the southern area.

58. As nests were constructed by the various birds on the islands, notes were taken on the substrate or vegetation in which the nest was constructed, size of the nest, materials from which the nest was fashioned, distance to nearest nest of the same species and different species, and height of nest above ground.

59. Attempts were made to monitor all marked nests on a regular basis but weather, bird disturbance and different nesting times for different species were instrumental in preventing this. As a result, information on nesting dates, clutch size, hatching success and fledgling success per species is too incomplete for a precise description of the dynamics of reproduction.

60. Colored slides were made of the different types of nests, eggs and young on each trip to the islands. The islands were over-flown and colored photographs were made of each in late May and early June. Additional slides were made of the vegetation, substrate and adult birds

on the various islands.

61. Lists of nesting birds (Appendix G), tables of nesting information on each species, (Appendix H and I), and maps of colony locations on specific islands have been prepared using the data gathered on the many study trips. The nomenclatural authority for birds was the AOU checklist (1957, 1973, 1976).

PART III: RESULTS

62. The history of each island, the type of substrate and soil, a summary of vegetation and certain aspects of bird activity are presented in the following summary of each study island in the two study areas. The islands in the southern area are discussed in sequence from north to south while those in the northern area are covered in groups as they occurred along channels or in bays.

Southern Study Area Islands

LM 15A

63. This island, located just north of the Kennedy Causeway in the northern part of the Laguna Madre, was constructed between 1 December 1945 and 19 January 1947. It was the largest and most northern of four original deposits, joined together by spread of the original deposits. Just prior to 1948, another small deposit was probably made on the southwest corner of the northern deposit. This material has since eroded away and the area was occupied by a mud flat containing little or no vegetation and was often inundated with water during high tides. Between 1948 and 1950 LM 15A was separated from its southern neighbors by a channel dug along its southern margin and in 1950 the three southern deposits were incorporated into the Kennedy Causeway extending between Flour Bluff and Padre Island. There appears to have been no further deposits since 1947 and 1948. Thus, this was one of the older islands in the southern group in terms of dredged material deposits.

64. The island, approximately 6.8 ha in size, formed a vegetated oval land mass along a northwest and southeast axis (Figure 5). The apex of the original deposit was slightly north of the center of the island at an elevation of 2.3 m. To the south, the aforementioned channel was heavily used by boats leaving several bait stands and public boat launching ramps on the Kennedy Causeway. The disturbance factor was probably as great on this island as on any other in the southern area although few people landed on the island except during duck and dove

1. *Prosopis glandulosa*

2. *Baccharis neglecta*

3. *Opuntia Lindheimeri, Andropogon glomeratus*

4. *Heterotheca subaxillaris, Hedyotis nigricans, Dalea emarginata, Bothriochloa saccharoides*

5. *Andropogon glomeratus, Ambrosia psilostachya, Paspalum monostachyum, Iva angustifolia*

6. *Paspalum monostachyum, Iva angustifolia, Andropogon glomeratus, Sporobolus virginicus*

7. *Dalea emarginata, Chloris petraea, Bothriochloa saccharoides*

8. *Sporobolus virginicus, Borrichia frutescens, Chloris petraea*

9. *Salicornia Bigelovii, Salicornia virginica, Suaeda linearis, Monanthochlöe littoralis*

o°o. *Sophora tomentosa*

Figure 5. Vegetation communities on Island LM 15A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

hunting seasons in the fall and winter. Cotton rats, *Sigmodon hispidus* Say and Ord, were observed on the island and their trails were numerous throughout the vegetation.

65. The substrate of the island was shell, sand and mud. The original deposit on the northern end contained valves of the locally extinct pelecypod *Macrocallista nimbosa* (Lightfoot), others such as *Chione cancellata* (Linne) and *Mercenaria campechiensis* (Gmelin) and the remains of old polychaete (serpulid) reefs. The sands on this island appeared to contain more silt than some of the other islands, judging from the darker color.

66. The vegetation on this island could be classified as climax vegetation for the islands in the southern area. The apex contained a dense growth of grasses of which *Bothriochloa saccharoides* was the major constituent. Other grasses included *Sporobolus virginicus, S. asper, Aristida intermedia,* and *Chloris* sp. interspersed with significant numbers of *Heterotheca subaxillaris* and *Hedyotis nigricans.* This type of vegetation appeared to be characteristic of the apexes of most of these older, undisturbed islands, and characteristic of the Coastal Prairie Region of this area.

67. On the higher elevations there were stands of two invader species, *Baccharis neglecta* surrounded by *Opuntia Lindheimeri.* Both species covered 100 percent of the area and the *B. neglecta* was 2 to 3 m in height and the *O. Lindheimeri* less than 1 m (Appendix F).

68. With decreasing elevation a community of *Andropogon glomeratus, Paspalum monostachyum, Ambrosia psilostachya* and *Iva angustifolia* was found. The two grasses, between 25 cm to 1 m in height, made up 80 percent of this community. At lower elevations the community graded into another of which *Paspalum monostachyum* made up 75 percent of the cover.

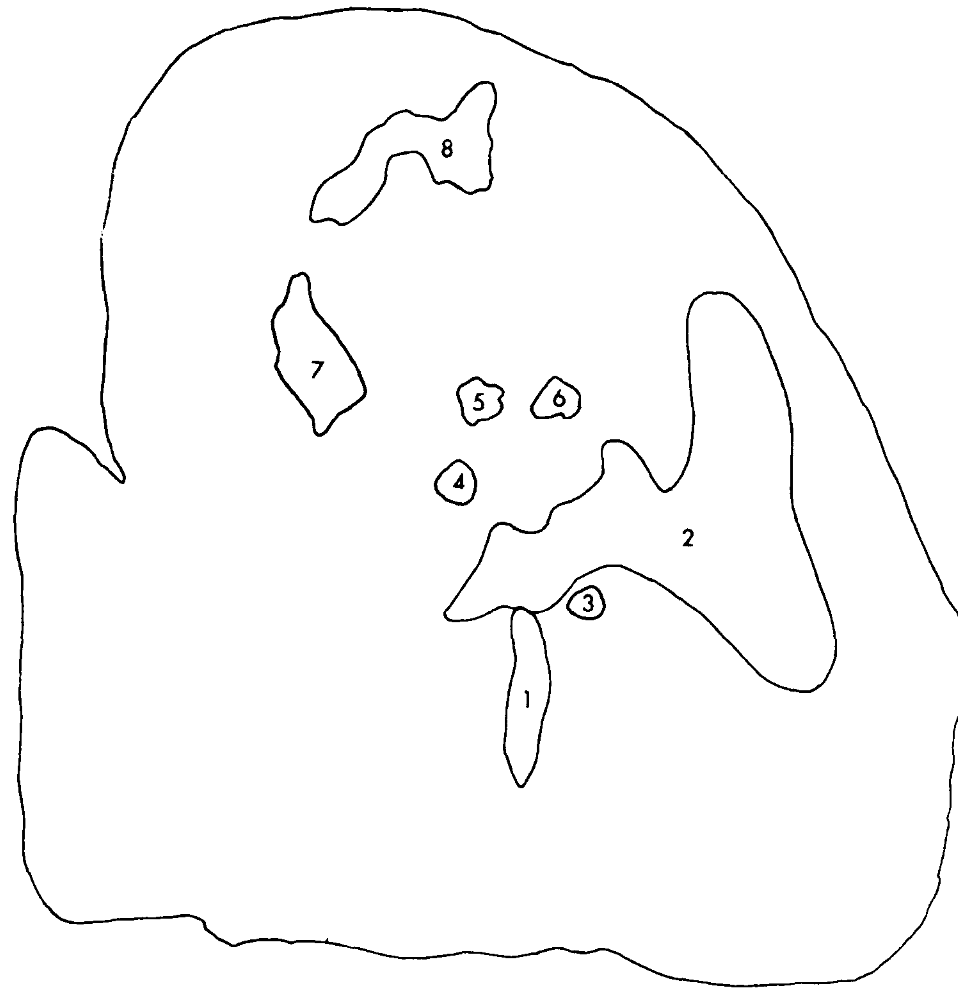
69. At the base of this deposit there was an area of *Sporobolus virginicus, Chloris petraea* and *Borrichia frutescens* which was transitional between the previous community and a community of halophytes consisting of *Salicornia Bigelovii, S. virginicus* and *Suaeda linearis.* Scattered at various elevations were four moderately sized, 3 m in height, *Prosopis glandulosa* trees and several *Sophora tomentosa* bushes.

70. Great Blue Herons, Cattle Egrets, Great Egrets, Snowy Egrets and Black-crowned Night Herons used the stands of *P. glandulosa, B. neglecta* and *O. lindheimeri* as nest substrates (Figure 6). The distance from the ground measured to the top of each nest, nest and bowl diameter and distance to nearest nest were taken on 28 Great Blue Heron nests and the data are presented in tabular form (Table 1) as an example of the type of information that was gathered for each species. Gull-billed Terns nested in association with Black Skimmers and Laughing Gulls in sparsely vegetated areas near the island shore. Ten nests of each species were marked and monitored on later trips (Appendix I).

LM 35A

71. This island was also formed between 1 December 1945 and 19 January 1947. The dredged material was formed into a typical round island with a central cone as a result of a single deposit. By 1956 there was some vegetation at the base of the cone and a house with pier had been constructed near the central western edge of the island. From the aerial photographs it appeared that an attempt had been made to unite several islands in the series by depositing dredged material between each island. Island 35A was connected to its two neighbors at this time, forming it into a more elongate oval land mass with low sand and mud flats on each end. There were probably deposits on the ends of the island in 1961 and 1968, but most of the material ran back into the water forming large barren underwater fans. There was further plant growth up the slopes by 1966 but in 1967 the crown was still bare. There had been little change in the appearance of the island since 1968 except that sparse vegetation has appeared on the crown.

72. At the time of this study, the island was an oval, 3.8-ha-land mass rising 1.8 m at its highest point above the waters of the Laguna Madre (Figure 7). The substrate was a rather hard one of mostly shell except at the two ends where there were extensive bare areas of mud and sand. There were two small intermittent fresh water ponds on the southeastern slope, the results of an undated small deposit whose material returned to the lagoon. These depressions were used as trash dumps by



1. Gull-billed Tern
   Least Tern
   Black Skimmer
2. Laughing Gull
3. Great Blue Heron
4. Great Blue Heron
   Black-crowned Night Heron
5. Great Blue Heron
   Snowy Egret
6. Great Blue Heron
   Snowy Egret
   Black-crowned Night Heron
7. Great Blue Heron
   Cattle Egret
   Snowy Egret
   Black-crowned Night Heron
   Great Egret
8. Laughing Gull

Figure 6. Location and species composition of nesting bird colonies on Island LM 15A.

Table 1

<u>Type of Substrate and Measurements of Great Blue Heron Nests on LM 15A</u>

BCNH - Black-crowned Night Heron, GBH - Great Blue Heron, CE - Cattle Egret, SE - Snowy Egret

Nest No.	Substrate	Nest Height (cm)	Nest Diameter (cm)	Nest Bowl (cm)	Nearest Species	Nest Distance (cm)
1	*Opuntia Lindheimeri*	91.4	76.2	33.0		> 198.0
2	*Baccharis neglecta*	96.5	68.6	33.0		> 198.0
3	*O. Lindheimeri & B. neglecta*	50.8	71.1	34.3	GBH	- 83.8
4	*B. neglecta*	99.0	48.3	30.5	CE	- 86.4
5	*B. neglecta*	157.5	55.9	33.0	Egret sp.	- 152.4
6	*B. neglecta*	94.0	73.7	-	Egret sp.	- 149.9
7	*O. Lindheimeri*	55.9	55.9	30.5	GBH	- 170.2
8	*B. neglecta*	68.6	71.1	30.5	SE	- 63.5
9	*O. Lindheimeri*	45.7	71.1	27.9		> 198.0
10	*B. neglecta*	96.5	71.1	33.0	BCNH	- 134.6
11	*Prosopis glandulosa*	172.7	53.3	-	GBH	- 111.8
12	*P. glandulosa*	124.5	73.7	35.6	GBH	- 111.8
13	*P. glandulosa*	172.7	58.4	30.5	Egret sp.	- 109.2
14	*P. glandulosa*	185.4	71.1	27.9	Egret sp.	- 99.1
15	*P. glandulosa*	144.8	58.4	27.9	BCNH	- 99.1
16	*P. glandulosa*	94.0	50.8	-	BCNH	- 111.8
17	*B. neglecta*	71.1	86.4	30.5	BCNH	- 114.3
18	*B. neglecta*	63.5	60.0	27.9	BCNH	- 134.6
19	*O. Lindheimeri*	25.4	60.0	38.1	GBH	- 170.2
20	*Sophora tomentosa*	73.7	55.9	-		> 198.0
21	*B. neglecta*	86.4	63.5	33.0	BCNH	- 139.7
22	*B. neglecta*	119.4	63.5	35.6	?	- 96.5
23	*O. Lindheimeri & B. neglecta*	45.7	60.0	30.5	GBH	- 83.8
24	*O. Lindheimeri & B. neglecta*	76.2	53.3	35.6		> 198.0
25	*B. neglecta*	66.0	55.9	27.9	SE	- 119.4
26	*B. neglecta*	48.3	73.7	33.0	Egret sp.	
27	*B. neglecta*	78.7	55.9	30.5	BCNH	- 86.4
28	*B. neglecta*	119.4	71.1	30.5	CE	- 94.0
	Averages	93.7 (n=28)	64.0 (n=28)	31.8 (n=28)		111.5 (n=23)

Figure 7. Vegetation communities on Island LM 35A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

the cabin owners.

73. There were six plant communities recognized on the basis of distribution and frequency of occurrence of each plant species (Figure 7). The vegetation of the crown was typical of the older undisturbed islands in the southern area. The unusual features were the presence of *Leucaena leucocephala* on the crown, the scattered *Tamarix ramosissima* and the fresh water ponds. *L. leucocephala* were isolated shrubs 1 to 2 m in height that provided a cover of 25 to 50 percent ground cover over a dense growth of herbs and grasses (Appendix F). The *T. ramosissima*, although scattered, were the dominant plants in the third community. They were 1 to 2 m in height and covered less than 25 percent of the ground. Small clumps of *Opuntia Lindheimeri* were also present in this area. There was no vegetation around the smaller of the two ponds because of periodic inundation with salt water, but the other was surrounded by *Typha domingensis, Tamarix ramosissima, Eleocharis montevidensis* and *Borrichia frutescens*.

74. No wading or fish-eating birds nested on this island during 1977. Rodent runways were numerous throughout the vegetation and one *Oryzomys palustris* (Harlan) was collected from under a board. There were many dog tracks, shotgun shells and clay pigeons scattered over the island. The presence of these artifacts could be an explanation for the lack of nesting on this island.

LM 39A

75. This island, constructed between 1 December 1945 and 19 January 1947, appeared as a large cone-shaped deposit almost connected to two smaller ones to the north (LM 39.5). A large channel separated it from the next island to the south. By 1956 there was sparse vegetation to the crown. In 1959 and 1961 dredged material was deposited on the southeast corner and northern slope from dredging of a channel between this island and LM 41 and maintenance dredging of the GIWW. Most of this material re-entered the water elevating the bottom in those areas. A house and pier had appeared on the western side by this date. Dredged material from maintenance dredging was deposited on the eastern slope between

1966 and 1967 and by 1968 all deposit areas appeared to be vegetated. Probably in 1970 or 1971, a deep channel was dug by an oil company separating this island from its neighbor to the north. The material was deposited within dikes on both islands. The diked area on 39A covered over one half of the area with vegetation and was located on the eastern side of the island. There was a break in the dike at the southern end and a small amount of the material escaped to the water. The vegetation appeared to be fairly dense on the dikes by 1973 and no other deposits have been made since then.

76. In 1977, the island was an elongate oval of 4.4 ha with a new apex formed within the diked area by deposition of the recent material (Figure 8). The older substrate of the island consisted of small to large pelecypod shells and serpulid reef material. The recent material within the dikes was fine sand, shell and powder-like silt forming a very uneven terrain.

77. The presence of this seven- or eight-year-old material provided an opportunity to examine plant succession on recently dredged material within dikes. Evidently, plant colonization was much more rapid, especially on the dikes, since they appeared to contain vegetation in 1973. This vegetation consisted of large clumps of *Heterotheca subaxillaris* approximately 30-50 cm in height and 1 m in width (Figure 8 and Appendix F). Accompanying the *H. subaxillaris* were small to large clumps of *Oenothera Drummondii*, approximately 20 cm in height. The northern and southern areas of the diked material were invaded by *Sporobolus virginicus*, *Sporobolus asper* and *Dalea emarginata* via an area on the crown of the island where the dike was not completed. The rest of the diked area was relatively bare except for scattered clumps of *H. subaxillaris* and *Oenothera Drummondii*.

78. Two low areas located in a trench on the northern end contained water year round. Again, *Typha domingensis*, *Eleocharis montevidensis* and *Borrichia frutescens* were found around the brackish water. The remainder of the island was covered with various communities of herbs and grasses. The halophytes occurred in low frequencies around the margins and there was one *Prospis glandulosa* tree near the cabin.

1. *Heterotheca subaxillaris, Oenothera Drummondii, Sporobolus asper, Dalea emarginata*
2. *Sporobolus virginicus, Heterotheca subaxillaris, Erigeron myrionactis*
3. *Borrichia frutescens, Monanthochlöe littoralis, Limonium Nashii, Salicornia virginica*
4. *Bothriochloa sacchariodes, Andropogon glomeratus, Sporobolus virginicus, Iva angustifolia*
5. *Paspalum monostachyum, Sporobolus virginicus, Ambrosia psilostachya, Fimbristylis castanea, Iva angustifolia*
6. *Suaeda linearis, Salicornia Bigelovii, Salicornia virginica, Sesuvium Portulacastrum*
7. *Andropogon glomeratus, Machaeranthera phyllocephala, Fimbristylis castanea, Borrichia frutescens*
8. *Typha domingensis, Eleocharis montevidensis, Andropogon glomeratus, Borrichia frutescens*
9. *Calylophus australis, Chloris petraea, Hedyotis nigricans, Aristida intermedia*
10. *Prosopis glandulosa*

▩. Cabin

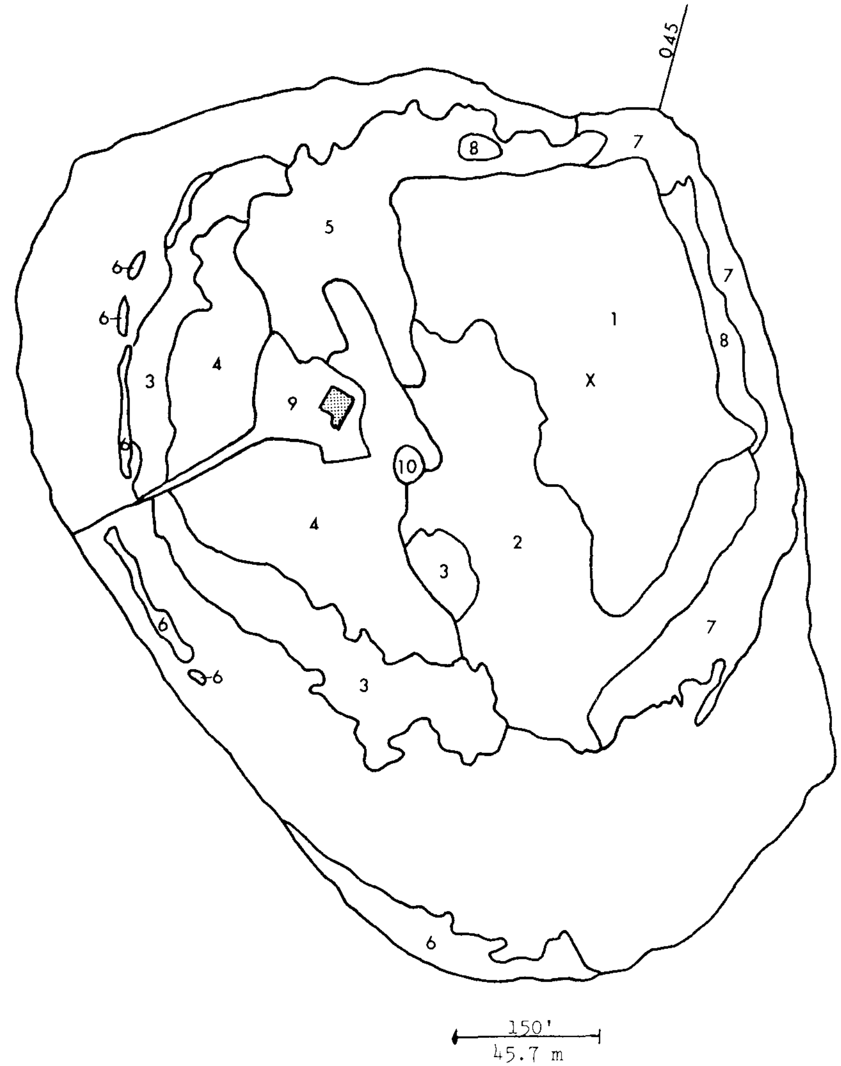


Figure 8. Vegetation communities on Island LM 39A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

Also cannas and Chinese Tallows were planted in the frequently mowed lawn surrounding the cabin.

79. Although 11 pairs of Least Terns nested on the island in 1973 on the barren dredged material, no wading or fish-eating birds nested in 1977. The owner of the cabin told of finding nests of Bob White Quail, Mourning Doves and Black Skimmers. He had started a rodent eradication program and had planted cottonwoods and Chinese Tallows but said they did not "do so well."

LM 43

80. This was another of the islands in the series that was constructed between 1 December 1945 and 19 January 1947. It was originally two separate round islands each with a central cone. By 1956 the two were almost joined by erosion of the two crowns and vegetation appeared as a "halo" at the bases of the crowns. A house and pier were present on each deposit in 1961 and there was additional vegetation on the slopes of the cone. Fresh material was deposited near the center of each cone in either 1962 or 1966. Most of the deposit ran back into the water cutting deep troughs on the eastern slope of each cone. A large deposit was made between the two original islands in late 1967 or early 1968 and the material from a channel between this island and LM 41A united the two original islands. In 1973 there was no vegetation on the recent deposit and the house on the northern cone was gone. There was evidence of extensive erosion and dense vegetation on the slopes of the elevated areas. The trenches formed by the run-off from the dredged material contained thicker vegetation than the older areas. There have been no further deposits and little change in vegetation.

81. The island was 11.1 ha in size and elevated 2.5 m in the area of most recent deposition (Figure 9). The substrate consisted of crusted sand and large shells in the older portions and finer, looser sand and shells in the newer part. Only five vegetation communities were recognized (Figure 9). All three peaks contained sparse vegetation with *Heterotheca subaxillaris, Oenothera Drummondii, Erigeron myrionactis* and grasses such as *Sporbolus* spp. Scattered throughout was *Tamarix*

1. *Heterotheca subaxillaris, Sporobolus asper, Erigeron myrionactis, Oenothera Drummondii*

2. *Heterotheca subaxillaris, Paspalum monostachyum, Cenchrus incertus, Indigofera miniata*

3. *Paspalum monostachyum, Sporobolus virginicus, Andropogon glomeratus, Iva angustifolia, Samolus ebracteatus*

4. *Fimbristylis castanea, Machaeranthera phyllocephala, Sporobolus virginicus*

5. *Suaeda linearis, Salicornia Bigelovii, Salicornia virginica, Sesuvium Portulacastrum*

ooo. *Tamarix ramosissima*

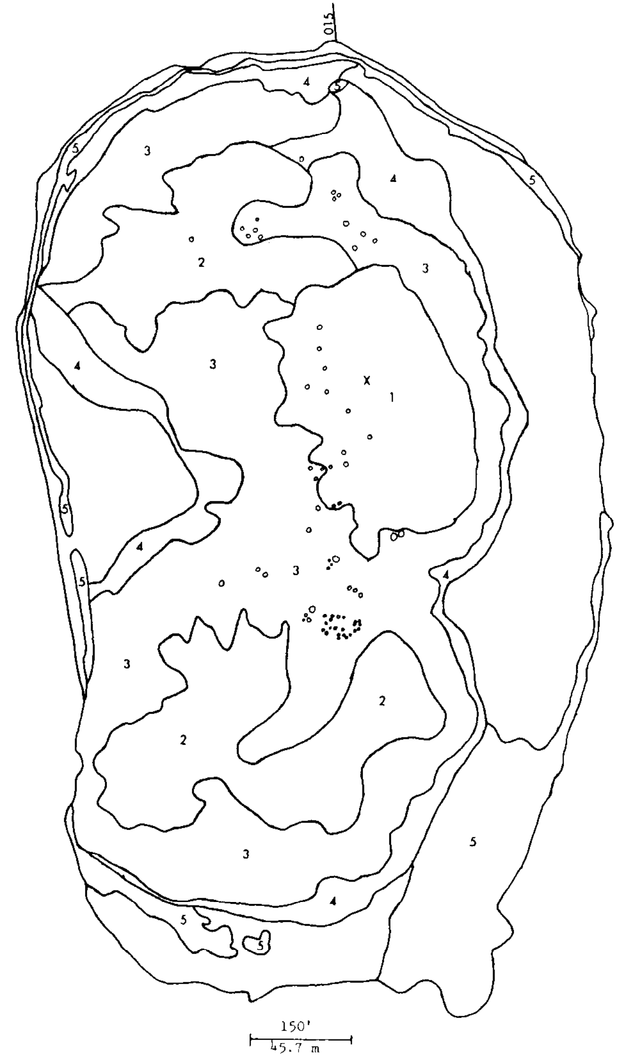


Figure 9. Vegetation communities on Island LM 43. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

ramosissima two to three m in height (Appendix F). A thin band of halophytes was found at the periphery of the broad sand and mud flat.

82. In 1973 Least Terns and Black Skimmers nested on the recent dredged material deposit. On 10 May 1977 seventeen Black Skimmer scrapes were found in the same more barren area of the island, community 1 (Figure 9), and 25 adults were seen. Ten of the scrapes were marked (Figure 10) but by 1 June all scrapes had been abandoned with no eggs deposited. Tracks and diggings of a carnivorous mammal were discovered and the presence of this animal could have caused the Black Skimmers to abandon their nests.

LM 43A

83. LM 43A island was constructed as a round cone-topped island in 1946, separated from all other islands in the series. In the 1948 and 1956 photographs there was little change other than the erosion of the crown. This erosional material connected this island to its northern and southern neighbors. In 1961 there was vegetation on the slopes and some near the summit and there was one house and pier on the western side. In 1962 or 1965 material from maintenance dredging was deposited to the east of the apex. The pressure of the discharge cut a deep channel and the slurry returned to the water on the eastern side of the island. In 1968 the island appeared to contain vegetation throughout and the pier was missing, probably as a result of Hurricane Beulah. Just prior to 1973 a petroleum company channel was dug between this and Island 45. Some of the material was deposited in a small rectangular diked area in the center of the island. The dike broke and spilled material into the water on the northeastern end. Scattered clumps of vegetation were present on the dike in 1973 and by 1976 there was vegetation on the spill area and some clumps were present in the center of the diked area. The house was gone.

84. This was one of the smaller islands in the series of dredged material islands along the GIWW in the Laguna Madre (Figure 11). It was 2.8 ha in size and the highest point was located on the dike, 1.8 m above sea level. The substrate of the older portion was similar to the other

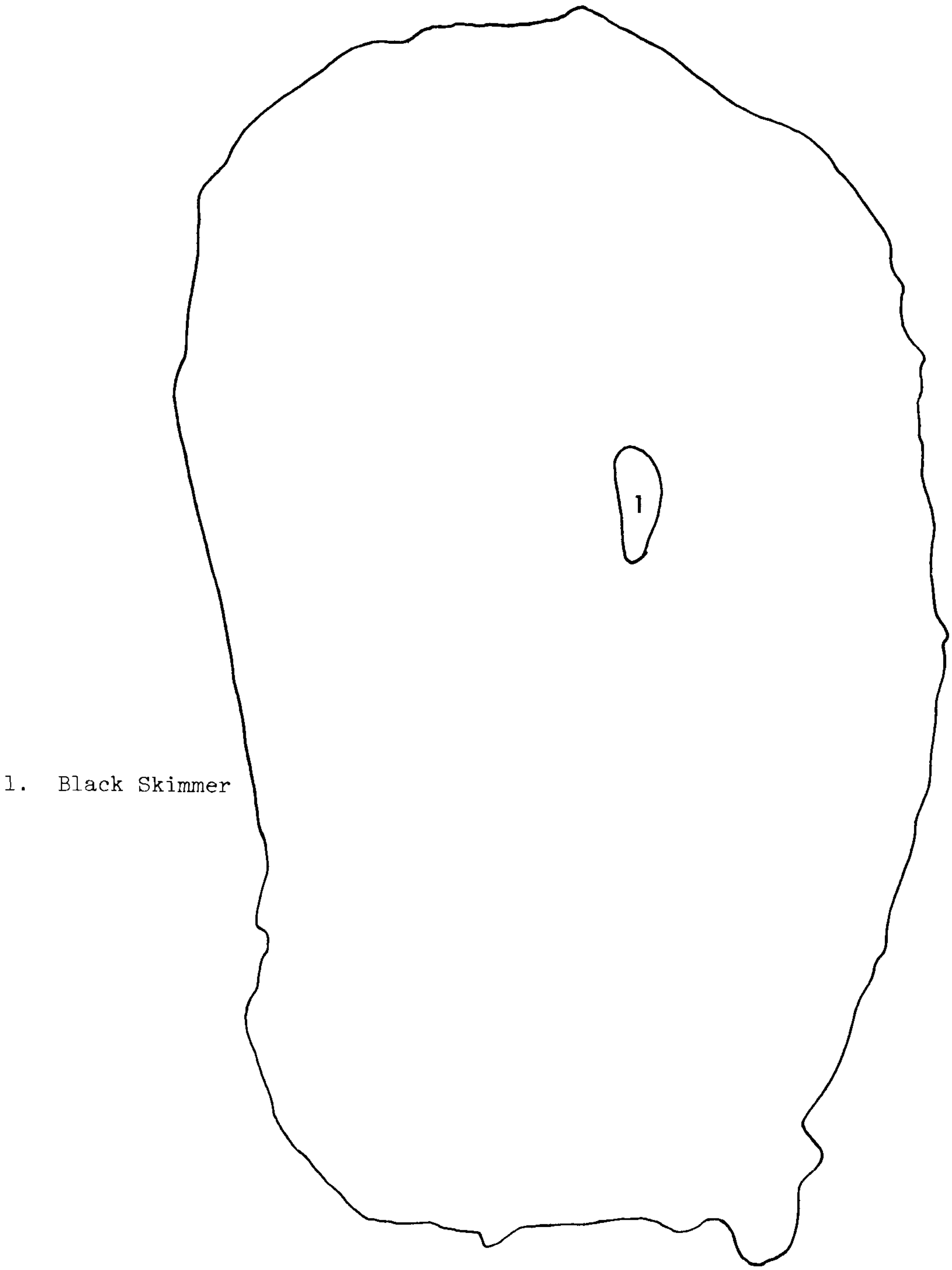


Figure 10. Location and species composition of nesting bird colonies on Island LM 43.

1. *Heterotheca subaxillaris, Hedyotis nigricans, Cenchrus incertus, Indigofera miniata, Dalea emarginata*

2. *Spartina patens, Andropogon glomeratus, Paspalum monostachyum*

3. *Paspalum monostachyum, Andropogon glomeratus, Iva angustifolia*

4. *Borrichia frutescens, Machaeranthera phyllocephala, Sesuvium Portulacastrum*

5. *Heterotheca subaxillaris, Sporobolus virginicus, Paspalum monostachyum, Borrichia frutescens*

6. *Heterotheca subaxillaris, Cenchrus incertus, Spartina patens, Oenothera Drummondii*

7. *Heterotheca subaxillaris, Cenchrus incertus, Chloris petraea, Indigofera miniata*

8. *Andropogon glomeratus, Machaeranthera phyllocephala, Fimbristylis castanea*

9. *Iva angustifolia, Machaeranthera phyllocephala, Fimbristylis castanea*

10. *Suaeda linearis, Salicornia Bigelovii, Borrichia frutescens, Sesuvium Portulacastrum*

11. *Sporobolus virginicus, Andropogon glomeratus, Paspalum monostachyum*

ooo. *Tamarix ramosissima, Prosopis glandulosa, Salix nigra*

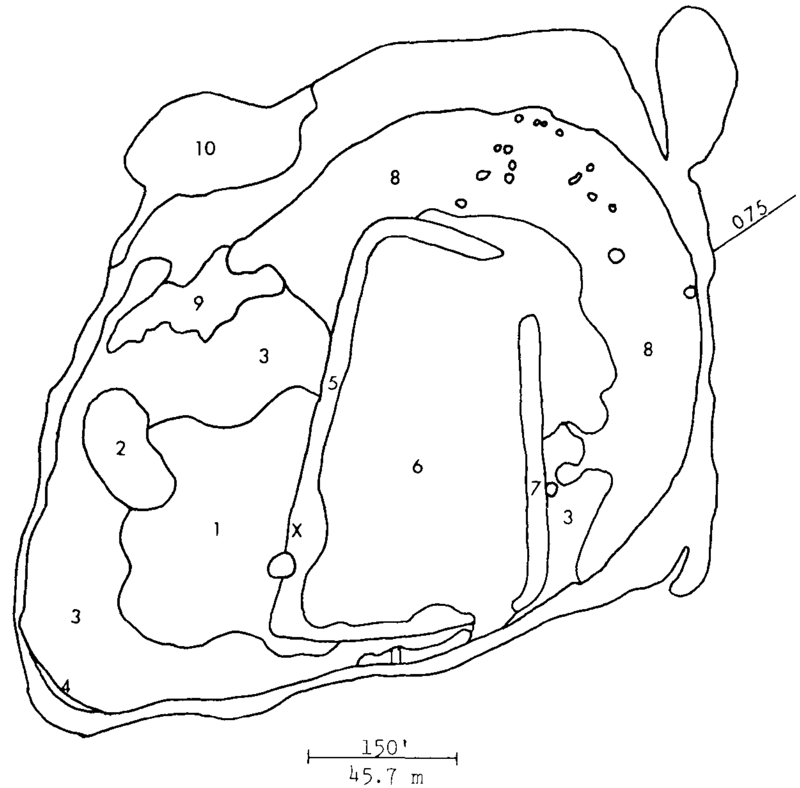


Figure 11. Vegetation communities on Island LM 43A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

islands of the same age and the material of the diked area was soft fine sand and small shell fragments.

85. There were eleven recognizable plant communities that graded into each other on the island (Figure 11 and Appendix F). The more recently deposited material in the diked area supported very scattered *Heterotheca subaxillaris, Spartina patens, Cenchrus incertus* and *Oenothera Drummondii.* This appears to be characteristic of those sandy areas within dikes established in the last eight years. The western part of the dike contained *H. subaxillaris, Borrichia frutescens* and grasses, while the eastern side contained *H. subaxillaris* and different grasses.

86. Twenty-four pairs of Least Terns nested in the newly diked area in 1973. There are no records for the succeeding years, but a single egg of this species was discovered in a scrape on the high barren spoil on 19 April 1977 (Figure 12). By 3 May another egg had been added and an additional scrape with two eggs in it was present. On 10 May all eggs were gone with no trace of shell or fragments. This disappearance may have been induced since the island was often used by picnickers and fishermen. The deep channel on the south side was used as an easy means of access to the shore of the island.

LM 47

87. This 3.9-ha-island was constructed in 1946 as a large round island west of North Bird Island (Appendix B). It was widely separated from its neighbors in the chain, more so to the south. There appeared to be little change in the island other than some probably halophytic vegetation around the periphery in 1948 photographs. By 1961, two houses and one pier had been erected and erosional material from the island had spread underwater toward LM 47A. In 1962 or 1966 a deposit was made on the crown, east of the summit, but the dredged material evidently returned to the water through a deep channel on the east side. In 1967 there were three houses and one pier. In 1968 the deep eastern channel was covered with thick vegetation and there was some vegetation on the crown by 1973. One house was gone but another had been added as well as two additional

1. Gull-billed Tern
Least Tern
Black Skimmer

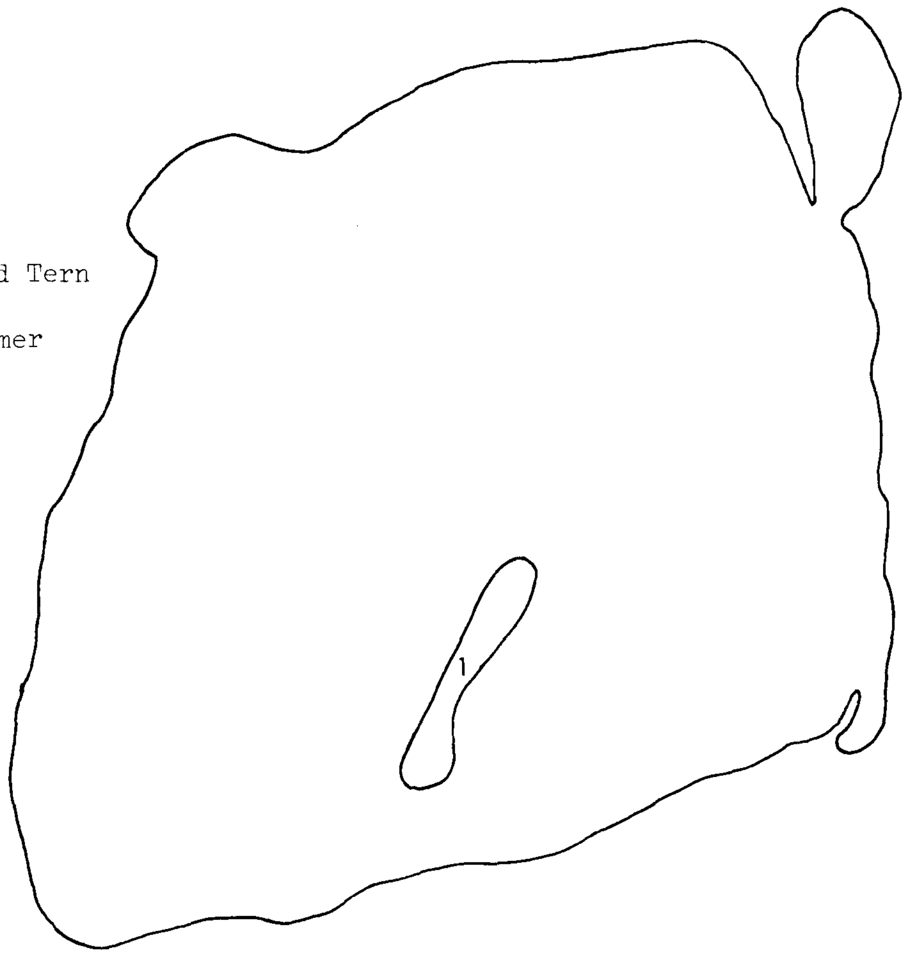


Figure 12. Location and species composition of nesting bird colonies on Island LM 43A.

piers. In late 1974 or early 1975 the entire island was enclosed with a 2.1-m-high dike and dredged material was deposited inside. There were three breaks in the dike, two to the north and one to the east. Large quantities of material ran out of the dike, especially to the west.

88. The new apex of the island was approximately 61.0 m northwest of the original apex and was an area of barren shell fragments and fine sand (Figure 13). Inside the dike there was one established community of scattered *Sporobolus asper, Heterotheca subaxillaris, Hedyotis nigricans* and *Dalea emarginata*. Most were usually less than 20 cm in height and covered approximately 30 percent of the ground (Appendix F). There were many *Tamarix ramosissima* scattered over the diked area, except near the apex. The only explanation for their presence is that they were there before the island was diked and they are recolonizing the areas where they once occurred.

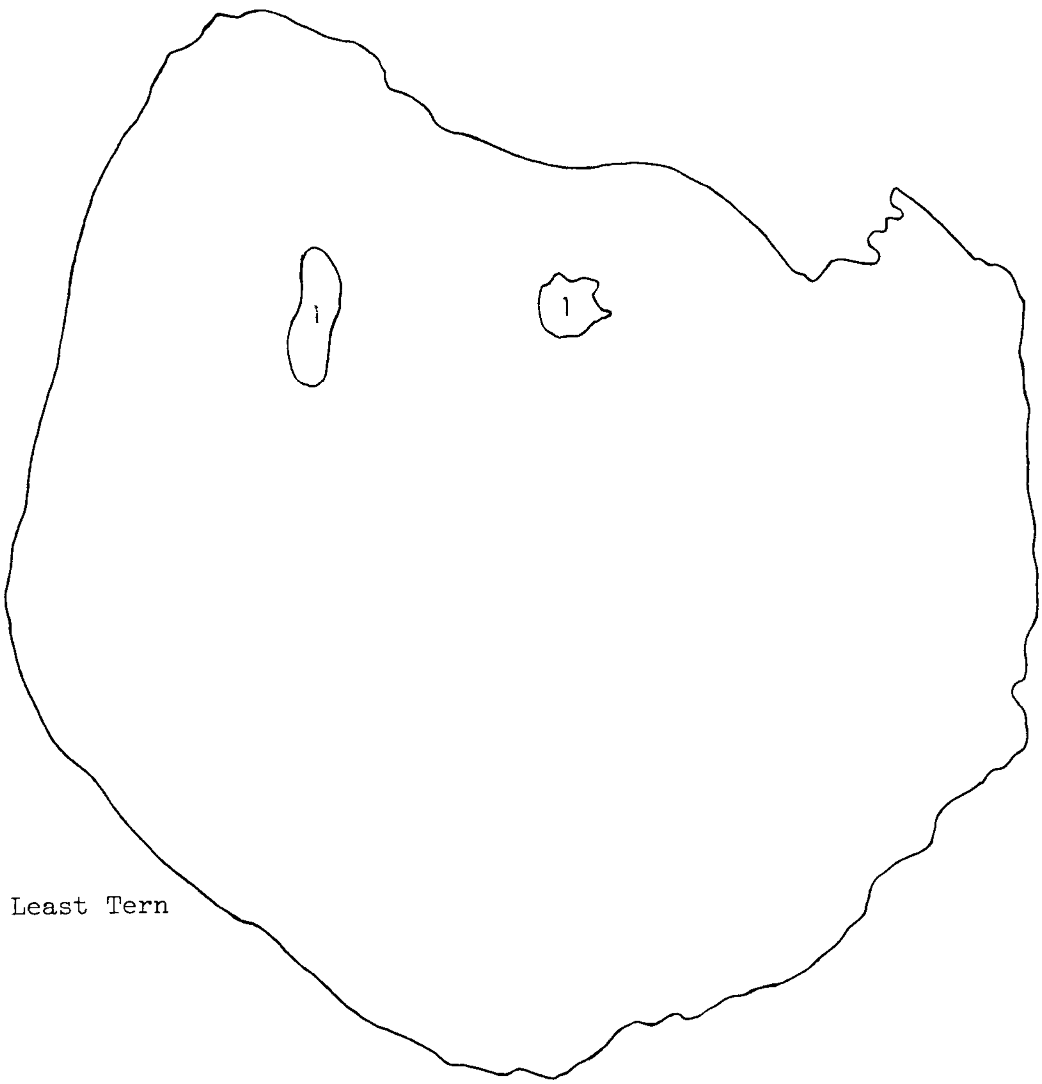
89. The dike contained thicker vegetation on the outer slope than on the top and sides, similar to conditions noted by Parnell (1977). *Sporobolus virginicus* was the dominant plant with *Paspalum monostachyum, Borrichia frutescens* and *Ambrosia psilostachya* occurring in lesser numbers. The northern and western shores were 100 percent covered by dense 0.9-m-wide mats of *Spartina patens, Paspalum vaginatum* and *Sesuvium Portulacastrum*. There are few previous bird nesting records for this island but 19 Black Skimmers were seen nesting on the barren sand in 1976. Least Tern nests were first found on this island on 3 May 1977, a single nest and egg in the diked area (Figure 14). This nest and egg were gone on 10 May but 16 other scrapes were found, three with single eggs. Eight adults were also seen on this date. On 1 June all scrapes, eggs and adults were gone, but on 10 June a single nest with one egg, and defended by two adults, was found. This nest was marked on 16 June when two eggs were present. All were missing on 27 June.

90. In September a drag line was brought to the island and dikes were elevated to a height of 3.6 to 4.6 m in preparation for deposit of material from maintenance dredging. Evidently, the island is to be raised to this level which would prevent nesting for many years, other than by a few Least Terns and Black Skimmers.

1. *Heterotheca subaxillaris, Sporobolus asper, Hedyotis nigricans, Dalea emarginata*
2. *Sporobolus virginicus, Paspalum monostachyum, Ambrosia psilostachya, Borrichia frutescens*
3. *Suaeda linearis, Salicornia Bigelovii, Atriplex arenaria*
4. *Spartina patens, Paspalum vaginatum, Sesuvium Portulacastrum*

ooo. *Tamarix ramosissima*

Figure 13. Vegetation communities on Island LM 47. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. Least Tern

Figure 14. Location and species composition of nesting bird colonies on Island LM 47.

LM 47.5

91. This was a large island constructed between 24 April 1947 and 5 March 1948 and formed by the fusion of two deposits, the smaller one to the south. It was separated from its neighbors by wide channels. There appeared to be little vegetation in 1948 but by 1961 this island was sparsely covered and two houses and a pier were present. There was a possible maintenance dredging deposit between 5 January and 11 April 1962 on the eastern side of both the small and large crowns. The material re-entered the water on the eastern side. The smaller crown was covered with vegetation with little exposed surface in 1967 and the larger crown contained vegetation only around the periphery. In 1973 the discharge troughs of 1962 were thickly covered with vegetation and there was some vegetation on the larger crown.

92. The apex of this 5.4-ha island was located on the larger northern crown and 2.3 m above sea level. The substrate and plant communities were those characteristic of the older undisturbed islands (Figure 15). The depression area caused by the discharge of material in 1962 was more densely covered with vegetation than other areas on the island, with *Andropogon glomeratus, Borrichia frutescens* and *Hydrocotyle bonariensis* covering 100 percent of the surface (Appendix F).

93. The bare areas on this island had served as nesting sites for Gull-billed Terns in past years (Ortiz 1974 and Mendoza 1974). During 1977 attempts to nest were made by Least Terns and Black Skimmers. Eleven adult Least Terns, 11 scrapes, 2 of which contained eggs, and 16 Black Skimmer scrapes were found near the apex on the sparsely covered slope on 3 May (Figure 16). They were all gone on 10 May after storms in the area on 9 May.

LM 47A

94. This small separate island was formed in 1947 and 1948 by coalescence of a larger northern and a smaller southern deposit. There has been little change other than a slow growth of the vegetation. Prior to 1967 three houses and two piers were constructed. In 1973 the

1. *Heterotheca subaxillaris, Hedyotis nigricans, Indigofera miniata, Chloris petraea*
2. *Paspalum monostachyum, Sporobolus virginicus, Samolus ebracteatus*
3. *Gaillardia pulchella, Aphanostephus skirrhobasis, Hedyotis nigricans, Chloris petraea*
4. *Andropogon glomeratus, Fimbristylis castanea, Sporobolus virginicus, Samolus ebracteatus*
5. *Andropogon glomeratus, Borrichia frutescens, Hydrocotyle Bonariensis*
6. *Typha domingensis, Eleocharis montevidensis*
7. *Suaeda linearis, Salicornia Bigelovii, Salicornia virginica*

°°°. *Tamarix ramosissima*

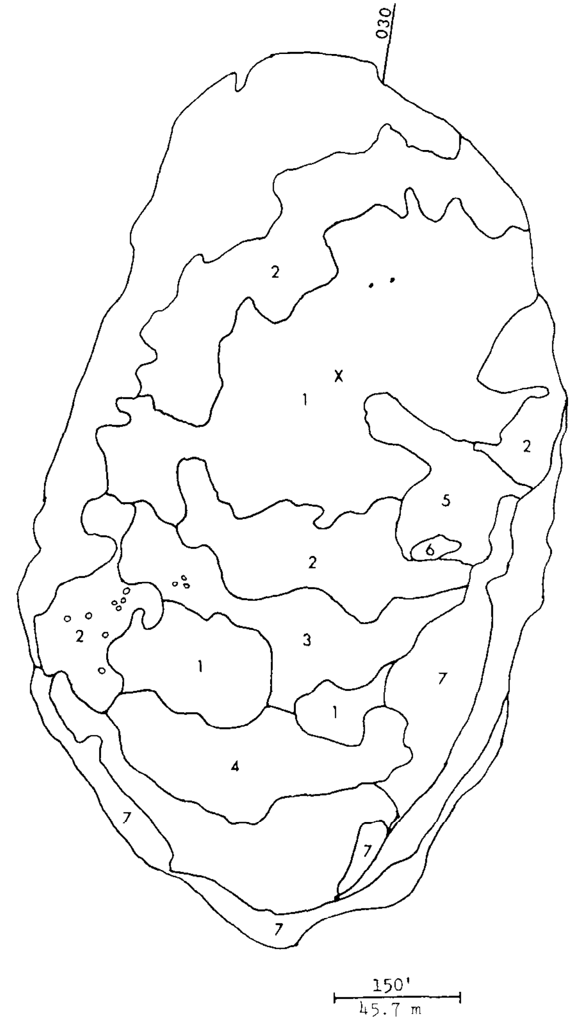
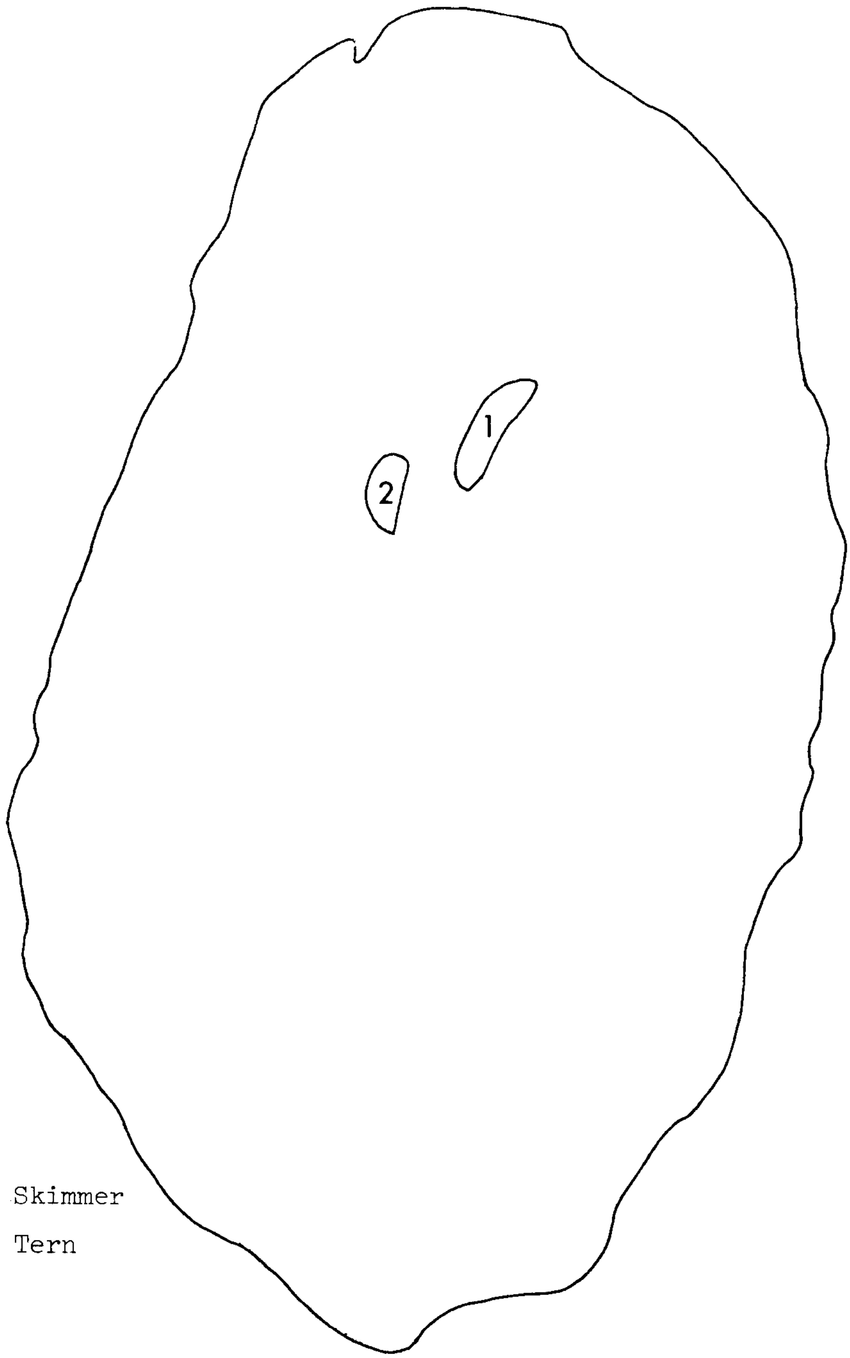


Figure 15. Vegetation communities on Island LM 47.5. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. Black Skimmer
2. Least Tern

Figure 16. Location and species composition of nesting bird colonies on Island LM 47.5.

vegetation was sparse and one of the houses had disappeared. In 1976 only the foundations and frames of the houses and remains of the piers were present.

95. In January of 1977 the island was an elongate oval of 3.4 ha with large areas containing little vegetation. There appeared to be little change in the vegetation, since the time of the studies by Ortiz (1974) and Mendoza (1974). Their more inclusive communities were divided into smaller ones. The vegetation of various grasses and herbs was characteristic of the older islands and was distributed in much the same fashion (Figure 17 and Appendix F).

96. Although 18 Black Skimmers were seen nesting on the island in 1976, none were seen during the 1977 nesting season.

LM 51

97. This island appeared in the early photographs as a large round island formed from two deposits, a larger one to the north and a smaller one to the south. The material, deposited in 1947 or 1948, was placed in such a way that the island was widely separated from its northern neighbor. At the time of construction, this was the last dredged material deposit made on the eastern side of the GIWW for several kilometers. Succeeding deposits were made on the western side (Appendix B). The possible reason for this shift in sides was to allow water circulation between the series of dredged material islands and Padre Island. In the 1967 photographs there was a deep channel on the eastern slope of the crown indicating that a deposit had been made in either 1962 or 1966 during maintenance dredging of the GIWW. Two houses and two piers had been constructed during this same time period. Between 1969 and 1973 a private channel was dug to Padre Island and the dredged material was deposited within a large dike covering half of the island on the eastern side. The dike broke on the northeastern and southeastern sides.

98. In 1976, the island was 4.9 ha in area and the highest point, located in the center of the diked area, was 4.0 m above sea level. The island was under the control of the Padre Island National Seashore and they dispossessed the cabin owners and destroyed the cabins.

1. *Heterotheca subaxillaris, Ambrosia psilostachya, Thelesperma filifolium, Hedyotis nigricans, Chloris petraea*
2. *Gaillardia pulchella, Eragrostis oxylepis, Hedyotis nigricans, Linum alatum*
3. *Paspalum monostachyum, Sporobolus virginicus, Iva angustifolia, Samolus ebracteatus*
4. *Machaeranthera phyllocephala, Fimbristylis castanea, Sporobolus virginicus*
5. *Monanthochlöe littoralis, Batis maritima, Salicornia virginica*
6. *Borrichia frutescens, Suaeda linearis, Salicornia Bigelovii, Salicornia virginica*
7. *Borrichia frutescens, Machaeranthera phyllocephala, Distichlis spicata*

Shack

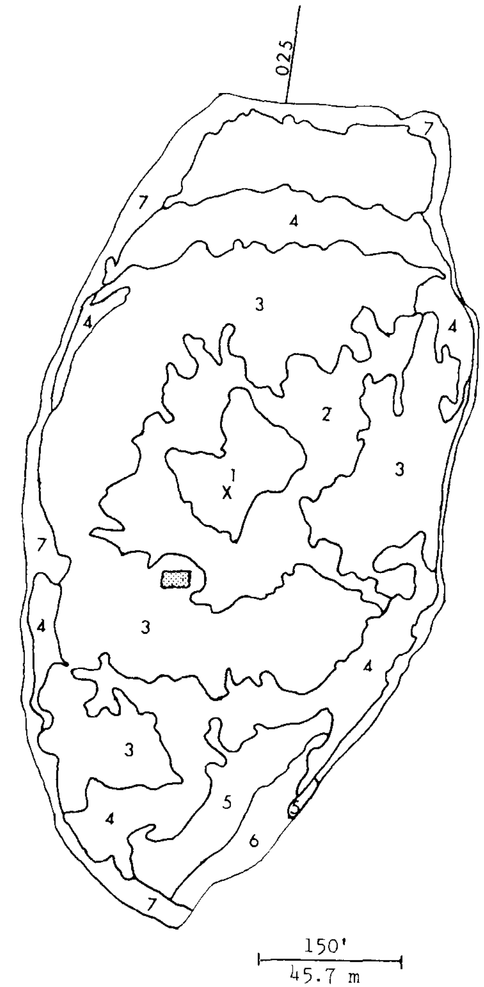


Figure 17. Vegetation communities on Island LM 47A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

99. The substrate and vegetation on the undiked portion was typical of the other 30-year-old islands. The material within the dike was very shelly and coarse, somewhat different from that on the more northern islands.

100. Most of the vegetation in the diked area was concentrated at the northern lower end where fresh water collected (Figure 18). This area appeared to have been invaded by plants through the broken dike walls on that end. Around the apex there were very scattered clumps of *Sporobolus asper, Hedyotis nigricans* and *Oenothera Drummondii* (Appendix F). There was rather dense vegetation on either side of the dike at the base of the slope. This could have been the result of nearness and concentration of water or accumulation of organic detrital material in that area.

101. One pair of Caspian Terns nested near the peak in the barren dredged material at the base of a clump of *Sporobolus asper* (Figure 19). The adults were first seen on 3 May 1977 and by 10 May two eggs had been deposited. Both eggs hatched and the unfledged young were last seen running on 1 June.

102. Thirty-eight Black Skimmers and ten Least Terns were counted on 3 May. Both species had made scrapes and one egg was present in a Least Tern scrape. On 10 May the Black Skimmers were still present but there was no further activity after that date. The adult Least Terns, their scrapes and egg were missing and were never seen again.

LM 55

103. This island was the most northern of a series of four isolated islands on the eastern side of the GIWW. Northeast of LM 55 and separated from it by only 182.9 m is South Bird Island, a long-established natural island rookery. It has long been famous as the only southern area in the United States where White Pelicans nest and it supports large nesting aggregations of most of the other colonial nesting birds as well.

104. LM 55 was constructed between 24 April 1947 and 5 March 1948 from a large central deposit and a smaller one on the northern end. The following changes have been recorded based on examination of aerial photographs:

1948 - Little change, some vegetation around periphery.

1. *Sporobolus asper, Hedyotis nigricans, Oenothera Drummondii*
2. *Paspalum monostachyum, Spartina patens, Machaeranthera phyllocephala, Samolus ebracteatus*
3. *Sporobolus virginicus, Heterotheca subaxillaris, Paspalum monostachyum, Gaillardia pulchella, Oenothera Drummondii*
4. *Sporobolus virginicus, Cenchrus incertus, Oenothera Drummondii, Heterotheca subaxillaris*
5. *Gaillardia pulchella, Sporbolus virginicus, Hedyotis nigricans, Indigofera miniata*
6. *Sporobolus virginicus, Ambrosia psilostachya, Sporobolus asper, Hedyotis nigricans*
7. *Hydrocotyle Bonariensis, Paspalum monostachyum, Samolus ebracteatus*
8. *Spartina patens, Heterotheca subaxillaris, Oenothera Drumondii*
9. *Paspalum monostachyum, Andropogon glomeratus, Iva angustifolia, Samolus ebracteatus*
10. *Gaillardia pulchella, Chloris petraea, Hedyotis nigricans, Heterotheca subaxillaris, Ambrosia psilostachya*
11. *Borrichia frutescens, Machaeranthera phyllocephala, Fimbristylis castanea, Salicornia virginica*
12. *Spartina patens*
13. *Andropogon glomeratus, Fimbristylis castanea, Paspalum monostachyum, Samolus ebracteatus*
14. *Batis maritima, Suaeda linearis, Salicornia Bigelovii, Salicornia virginica*
15. *Suaeda linearis, Salicornia Bigelovii*

ooo. *Nerium Oleander, Washingtonia robusta, Prosopis glandulosa*

Figure 18. Vegetation communities on Island LM 51. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

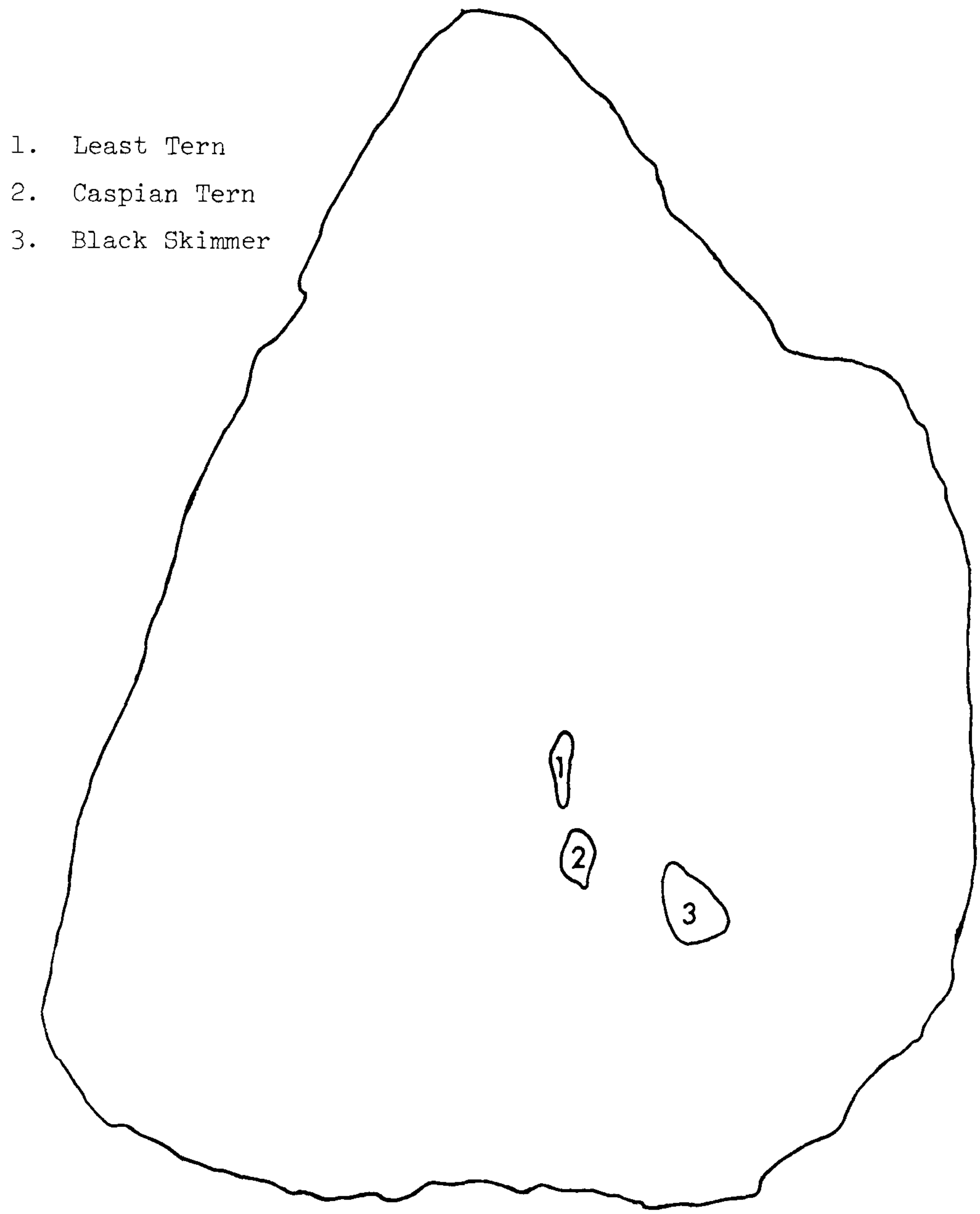


Figure 19. Location and species composition of nesting bird colonies on Island LM 51.

1949 - Some vegetation at base of dome and some on the dome peak. This could be the beginning of the stand of *Leucaena leucocephala* that was present during the study. The smaller peak was eroded and appeared flat.

1967 - A deposit was probably made in 1962 on the north slope. It cut a deep trench and most of the material ran back into the water. The crown was sparsely vegetated and trees could be present.

1969 - More vegetation on slopes and there was a definite grove of trees on the central dome.

1974 - Almost completely vegetated.

1976 - Well vegetated and no new deposits.

105. In 1977 the island covered 3.7 ha and was elevated to a height of 1.8 m on the dome. The substrate was typical of the older islands as was the vegetation. The major difference was the dense grove of *Leucaena leucocephala* growing in a depression at the peak of the dome (Figure 20). The trees provided 100 percent cover and ranged from 2 to 4 m in height (Appendix F). The trunks of the trees were long and straight and did not branch until they attained a height of over 1 m. The ground under the trees was of loose sand and shell fragments, covered with a thick layer of leaves and twigs. Surrounding the *L. leucocephala* was a band of dense *Opuntia Lindheimeri,* 1 m or less in height and covering almost 100 percent of the 4-m-wide band. There were four groups of *Prosopis glandulosa* west of the crown and *Tamarix ramosissima* was scattered in Community 5 on the western side of the island.

106. Most of the birds that nested on LM 55 did so in close association with the grove of *L. leucocephala,* the *O. Lindheimeri* and the *P. glandulosa* (Figure 21). A few Laughing Gulls nested on the northern end of the island in vegetation communities 5 and 10. Nests were counted, marked and monitored (Appendix I). Unfortunately the data are not complete because all investigative work was halted on this island when it was discovered that the White Pelicans, if disturbed, would not return to their nests for extended periods. Later, after their eggs had hatched, human presence seemed to cause little harm.

107. Thirty Great Blue Herons were flushed from the *L. leucocephala* and *P. glandulosa.* The average height of five nests was

1. *Leucaena leucocephala, Opuntia Lindheimeri*
2. *Heterotheca subaxillaris, Opuntia Lindheimeri, Hedyotis nigricans, Sporobolus cryptandrus, Indigofera miniata*
3. *Sporobolus virginicus, Ambrosia psilostachya, Palafoxia texana, Aristida intermedia*
4. *Prosopis glandulosa*
5. *Andropogon glomeratus, Palafoxia texana, Borrichia frutescens, Sporobolus virginicus*
6. *Batis maritima, Borrichia frutescens, Sesuvium Portulacastrum*
7. *Borrichia frutescens, Machaeranthera phyllocephala, Sporobolus virginicus*
8. *Monanthochlöe littoralis, Salicornia virginica, Batis maritima, Borrichia frutescens*
9. *Suaeda linearis, Atriplex arenaria, Salicornia Bigelovii, Salicornia virginica*
10. *Heterotheca subaxillaris, Baptisia leucophaea, Calylophus australis, Thelesperma filifolium, Hedyotis nigricans*
11. *Machaeranthera phyllocephala, Fimbristylis castanea, Sporobolus virginicus*
12. *Lycium carolinianum, Batis maritima*

ooo. *Tamarix ramosissima*

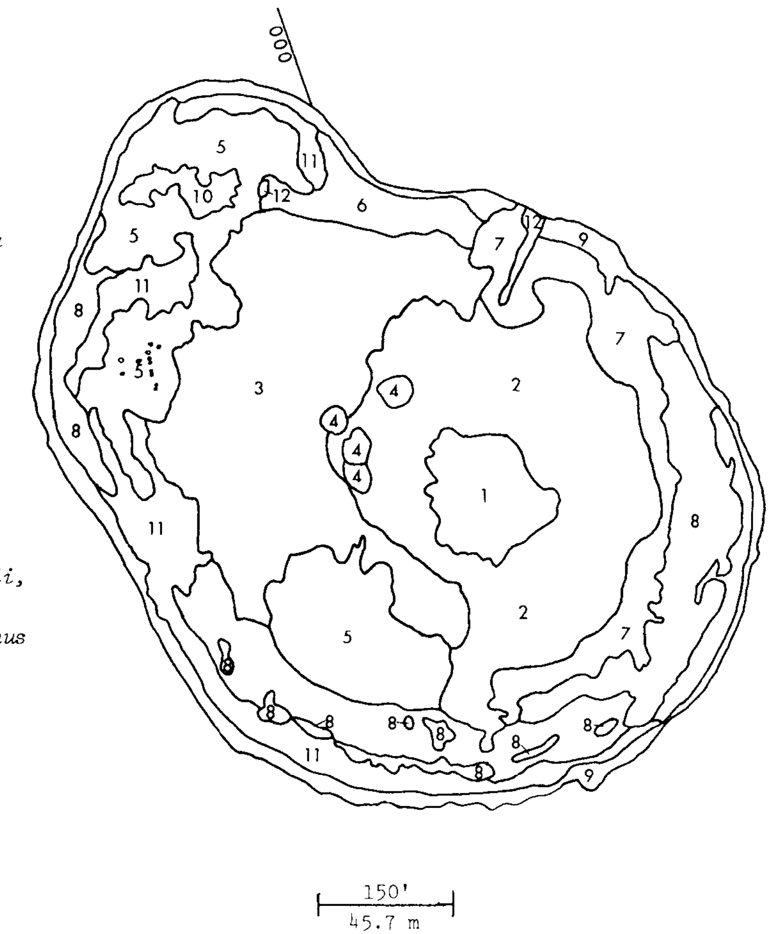
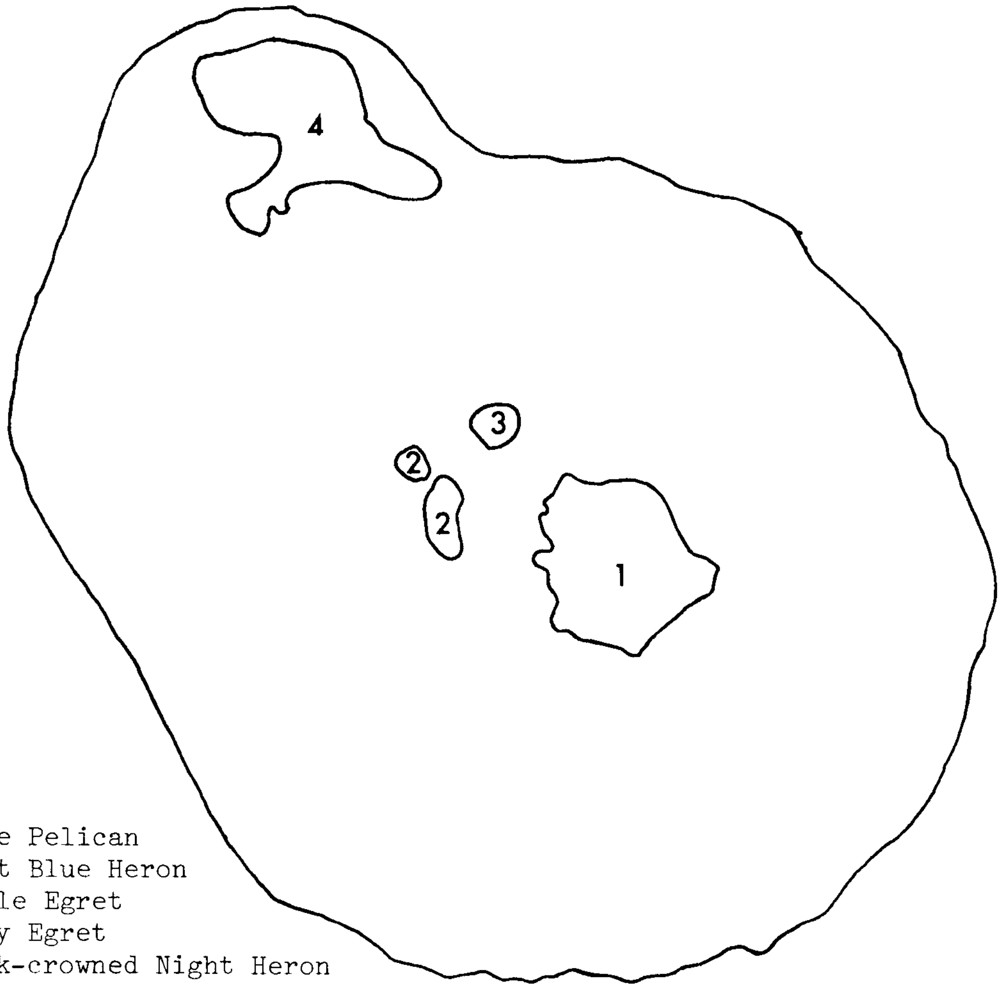


Figure 20. Vegetation communities on Island LM 55. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. White Pelican
   Great Blue Heron
   Cattle Egret
   Snowy Egret
   Black-crowned Night Heron
2. Great Blue Heron
   Cattle Egret
   Snowy Egret
   Black-crowned Night Heron
3. Great Blue Heron
   Snowy Egret
   Cattle Egret
   Black-crowned Night Heron
4. Laughing Gull

Figure 21. Location and species composition of nesting bird colonies on Island LM 55.

103.6 cm; diameter of nests and bowls averaged 71.1 and 33.8 cm, respectively, for three nests. The average distance to the nearest nest was 94.0 cm. Although the data are incomplete, fledged young were seen.

108. Black-crowned Night Herons were first seen on 18 February 1977 in the grove of trees. On 25 March, 50 nests with 129 eggs and 5 chicks were recorded. The nests were variable in both height and mode of construction. The nests were constructed of twigs across the branches of the trees and usually no higher than 2.4 m above the ground. They were in close association with the nests of other wading birds but usually more toward the interior of a tree. Young were off the nests and some almost fledged on 11 May. On 7 June, many fledglings were seen leaving the island and on 10 June 35 adults were counted. Fledglings were still present on 28 June.

109. Snowy Egrets were found inside the grove of trees on 3 May and ten nests were marked on 25 May (Appendix I). The nests were in the same trees and near the nests of the previous species. Their platforms were nearer the exterior of the tree and were much more tightly woven than those of Cattle Egrets. By 28 June most of the young had fledged and left the island.

110. Two hundred pairs of Cattle Egrets were estimated by aerial count to be on the island on 26 April. Ten nests with an average of 2.6 eggs per nest were marked on 12 May (Appendix I). On 7 June an estimate of 172 individuals was made from ground observations. Although all marked nests were empty, some nests still contained eggs on 22 July. Most young had fledged by this time.

111. Fifty pairs of White Pelicans were seen from the air on this island on 7 March and on 25 March 120 nests were counted under the canopy of *L. leucocephala*. They were small raised mounds of sticks and other organic detritus with an 10.3- to 25.4-cm-wide bowl in the center of the mound. The nests were positioned around the periphery next to the *O. Lindheimeri* to 5 m toward the center of the grove. There were no nests in the center of the grove of trees. Of the 120 nests, 105 contained a total of 192 eggs, 82.9 percent with two eggs and 17.1 percent with one egg. Ten nests located on the periphery were marked on 10 May (Appendix

I). On 22 July a possible renest with two eggs was found. Most young were near fledging or had fledged; 75 were counted.

112. White Pelicans nested on this island for the past two years and will continue to do so if left undisturbed. They were evidently ones that have been crowded from their traditional nesting site on South Bird Island. This island seemed to offer more protection from the elements since there were no trees on South Bird Island.

113. Six Laughing Gull nests were found on the northern end of the island on 25 May. Seventy adults were counted on 7 June but no eggs or young were found.

114. There appeared to be a steady increase in the numbers of birds and species using this island. The count of 64 Great Blue Herons in 1977 was 61 more than the previous year's count. There were 140 more White Pelicans, 85 more Black-crowned Night Herons, the same number of Snowy Egrets and a decrease of 650 Cattle Egrets. This was the first year that Laughing Gulls had been reported nesting on the island.

LM 57

115. LM 57 was a large island constructed in either 1947 or 1948, formed into a tear-shape by the deposition of a large quantity of dredged material to the north and a smaller amount to the south. In 1953 material from maintenance dredging was deposited on the larger, northern dome. A channel was cut by the force of the water and most of the material ran back into the water on the eastern side. By 1968, two houses had been constructed and dense vegetation was present at the bases of the domes. Erosional scars were very evident and the discharge channel contained vegetation.

116. Between 1968 and 1973 a large deposit was made near the northern end of the island at the shore line. Two other smaller deposits were made at the southern end, all of which merged with the original island forming a single island with five domes. These deposits were probably made in 1969 as a result of the construction of a small channel on the eastern side of the island. In 1973, the three new domes were barren of vegetation but some was present in 1974 and by this time the main body

of the island was covered with vegetation. In 1976, the houses had been destroyed but there was little other change.

117. The addition of the dredged material enlarged this island to 7.2 ha. The apex was located on the new northern dome and was 1.9 m above sea level. The substrate of the new domes contained more shell than the original island and was finer and less densely packed. Rodent trails were numerous in the vegetation and there was a large burrow under the foundation of one of the houses, either a coyote or a badger.

118. The vegetation of the older part of the island consisted of herbs and grasses like those of LM 15A (Figure 22). The plants were less frequent on the domes than those on islands of comparable age. Vegetation on the newer domes was typical of vegetation on mounds of this age, thick at the base with thinner stands of grasses at increased elevation. The vegetation was sparse on the summit and tended to develop in the erosional troughs first. Just prior to the nesting season, personnel from the Padre Island National Seashore removed all vegetation from a rectangular plot on the summit of the northern dome and another on the summit of the larger, southern dome. Both plots were used as nesting sites by Black Skimmers and Caspian, Royal and Sandwich Terns (Figure 23). Black Skimmers and Gull-billed Terns used the more barren areas on the larger dome of the older part of the island and Laughing Gulls constructed their nests in the thicker vegetation of the most recent dredged material areas.

119. Caspian Terns were the first to use the artificially cleared areas, appearing on nests on 29 March. On 3 May 82 scrapes were counted, 59 of which contained a total of 102 eggs. The nests were located near the apex of each mound and near the margins of the cleared areas. Ten of these nests were marked on 11 May and monitored on later trips (Appendix I). Fledging success was not determined because the chicks moved from the nesting area and individual identification was impossible.

120. Royal Terns also nested on both cleared areas in close association with Sandwich Terns. The breeding chronology of these two species appeared to be nearly parallel. Breeding aggregates of both species were first seen in the cleared areas on 25 May. Ten nests of each were marked and monitored on subsequent visits (Appendix I). On 10 June, 82 adults

1. *Heterotheca subaxillaris, Calylophus australis, Chloris petraea, Gaillardia pulchella, Thelesperma filifolium*
2. *Ambrosia psilostachya, Sporobolus virginicus, Andropogon glomeratus, Chloris petraea*
3. *Machaeranthera phyllocephala, Sporobolus asper, Erigeron myrionactis, Oenothera Drummondii, Lepidium virginicum*
4. *Andropogon glomeratus, Borrichia frutescens, Erigeron myrionactis, Samolus ebracteatus*
5. *Machaeranthera phyllocephala, Borrichia frutescens, Sesuvium Portulacastrum, Limonium Nashii*
6. *Paspalum monostachyum, Andropogon glomeratus, Samolus ebracteatus, Machaeranthera phyllocephala*
7. *Fimbristylis castanea, Sporobolus virginicus, Machaeranthera phyllocephala, Salicornia virginica*
8. *Tamarix ramosissima, Maurandya antirrhiniflora, Lantana Camara*
9. *Suaeda linearis, Atriplex arenaria, Salicornia Bigelovii, Salicornia virginica, Sesuvium Portulacastrum*
10. *Borrichia frutescens, Lycium carolinianum, Sesuvium Portulacastrum, Limonium Nashii*
11. *Borrichia frutescens, Batis maritima*
12. *Borrichia frutescens, Sporobolus virginicus, Ambrosia psilostachya, Lycium carolinianum*

Figure 22. Vegetation communities on Island LM 57. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

Figure 23. Location and species composition of nesting bird colonies on Island LM 57.

and 52 active nests of Royal Terns were counted. No eggs had hatched at that time but on 27 June, 80 percent of the nests were empty and unfledged chicks were seen running on the mud flat.

121. On 10 June, 420 adults and 434 nests of Sandwich Terns were counted. The nests were distributed within 40 cm of adjacent nests. Subsequent development was similar to that of the Royal Tern (Appendix I).

122. Nesting by the Black Skimmers in all the more barren areas was difficult to follow because of the prolonged nesting period. Nests were marked some of which were later abandoned while others fledged young (Appendix I). When counted on 10 June, there were 35 adults and 24 scrapes, only two with eggs. On 16 June, 20 chicks were seen in the colony area. A late clutch of two eggs was found on 28 June but its fate was unknown.

123. Gull-billed Terns nested in the rock and sand substrate on the old part of the island (Figure 23). The first nests were found on 11 May at which time ten were marked, and later checked on each trip. All nests were surveyed on 25 May with the following results: five nests contained one egg, 11 contained two and six contained three eggs. The results of the ground count on 10 June were 38 adults and 22 nest scrapes. All nests were empty on 16 June and no hatchlings or fledglings were seen.

124. Laughing Gulls were seen on the island throughout the study period but nested in low numbers and few nests, if any, were successful. Ten nests were staked on 11 May and an average clutch size of 2.6 eggs per nest was determined (Appendix I). On 25 May, only 3 nests contained eggs and no shell fragments were found in the empty nests. A nest stake had been transplanted which could indicate human disturbance. On 10 June, 20 adult gulls were counted and no nests or young were found. A nest with one egg was found on 28 June but it was not checked after that date.

125. Although there were fewer birds and nests of all species than in 1976, the numbers compared favorably with those of other years. The most notable difference between 1977 and other years was the addition of the large colonies of Royal and Sandwich Terns. Both used the artificially cleared areas, which indicated what proper management could accomplish.

LM 57A

126. This island was constructed during the same time period as the previous one and was formed as the smaller and most southern island of an isolated group of four on the eastern side of the GIWW (Appendix B). The first deposit was a large one forming a high mound as the center of the island. The second was small and located on the southern end. In the 1948 aerial photograph there was little change in the shape and there was little or no vegetation. In 1956 there was some vegetation along the slopes and a deposit had been made on the northern end, probably in 1953. The deposition of the material created a large water-filled crater but most of the slurry ran back to the Laguna Madre forming a small pointed extension almost connecting the island to LM 57. A deposit probably made in 1962 on the southeastern corner enlarged the island in that direction. The deposit appeared as an elevation covered with vegetation in the 1968 photographs. Two fresher deposits were also present, one on the southern end and the other on the mid-eastern side. Most of this material flowed back into the water and the mounds that were left were very low. One or two large deposits were made in late 1968 or early 1969 that formed a large dome on the mid-eastern side. Most of the run-off was to the north and the island was almost doubled in width. The material was taken from a channel dug to the east of the four islands in this group. There had been no further deposits by 1973. There was vegetation on all of the island except for the crown of the recent deposit and much of the material from the latter had eroded back into the water to the north and east.

127. In 1976, the island covered 7.4 ha and was elevated to 1.9 m on the peak of the newer dome. There were four visible low mounds present in the latest aerial photograph. Each of these mounds contained sparse vegetation on the crown with various grasses and herbs (Figure 24). As usual on most of these mounds, the vegetation was more dense toward the base and consisted of grasses and herbs. The unusual vegetation feature was the groups of low *Tamarix ramosissima* surrounded by dense stands of *Borrichia frutescens* and *Lycium carolinianum*. The latter two species formed such thick mats that it was difficult to walk through them and they seemed to occur on the lower parts of the island in the depression where

1. *Gaillardia pulchella, Sporobolus virginicus, Ambrosia psilostachya, Aphanostephus skirrhobasis, Indigofera miniata*
2. *Calylophus australis, Chloris petraea, Thelesperma filifolium, Baptisia leucophaea, Hedyotis nigricans*
3. *Tamarix ramosissima, Solanum americanum, Cakile fusiformis*
4. *Heterotheca subaxillaris, Cenchrus incertus, Sporobolus cryptandrus*
5. *Sporobolus asper, Machaeranthera phyllocephala, Cenchrus incertus, Oenothera Drummondii*
6. *Tamarix ramosissima, Lycium carolinianum, Sporobolus virginicus, Solanum texense, Ambrosia psilostachya*
7. *Borrichia frutescens, Sporobolus virginicus, Limonium Nashii, Lycium carolinianum*
8. *Hedyotis nigricans, Machaeranthera phyllocephala, Borrichia frutescens, Sesuvium Portulacastrum Limonium Nashii*
9. *Heterotheca subaxillaris, Chloris petraea, Hedyotis nigricans, Sporobolus virginicus*
10. *Suaeda linearis, Salicornia Bigelovii, Monanthochlöe littoralis, Salicornia virginica, Batis maritima*
11. *Borrichia frutescens, Ambrosia psilostachya, Sporobolus virginicus, Hydrocotyle Bonariensis*
12. *Andropogon glomeratus, Borrichia frutescens, Fimbristylis castanea, Machaeranthera phyllocephala, Sporobolus virginicus*
13. *Monanthochlöe littoralis, Machaeranthera phyllocephala, Borrichia frutescens, Sesuvium Portulacastrum, Limonium Nashii*

ooo. *Tamarix ramosissima, Prosopis glandulosa, Leucaena pulverulenta, Phoenix canariensis*

■. Pond

Figure 24. Vegetation communities on Island LM 57A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

materials from two of the mounds had run together (Appendix F). The low elevation of the island, its large size and the probable nearness of the vegetation to the water table were possible reasons why this island had developed such a luxuriant growth of plants. Mendoza (1974) and Ortiz (1974) found much the same type and density of vegetation in 1973 and 1974. The crowns of the mounds were almost barren, especially the eastern one. There was a single palm and a single large *Leucaena pulverulenta* near the house foundation on the northern end.

128. This island supported one of the largest populations and greatest diversities of species of birds of any dredged material island in the southern area. If islands were to be constructed for nesting birds, this would be one in the southern area to duplicate.

129. Cattle Egrets, Snowy Egrets, Great Blue Herons and Black-crowned Night Herons nested in and on the *Tamarix ramosissima,* the *Prosopis glandulosa* and the *L. pulverulenta* (Figure 25). Around the trees, in and on the *B. frutescens, A. psilostachya* and *L. carolinianum,* Louisiana Herons, White-faced Ibises, Reddish Egrets and a few Snowy Egrets built their nests, laid their eggs and raised their young (Figure 25, Appendix I). Laughing Gulls used much of the area of sparse vegetation along the shore, the upland areas of the older part of the island and some areas around the other bird colonies that contained thick vegetation as nesting sites. Approximately 2500 adults were estimated by a ground party on 10 June and because of these huge numbers their nesting success was difficult to determine. However, some nests were marked and monitored (Appendix I).

130. One pair of Sooty Terns nested under a *B. frutescens-Coreopsis* spp. canopy near the southern shore of the island. There was one egg which hatched and the chick was presumed to have fledged. This could be the same pair that nested on the island in 1974 and 1975.

131. The other unusual nesting species for the southern area was a pair of White Ibises that nested in the salt cedar in the north-central portion of the island. The nest was approximately 0.6 m above the ground and contained two eggs on 25 May. Two young hatched and were fledging on 16 June. Two additional nests, each with two eggs, were found on 22 June,

1. Great Blue Heron
2. Laughing Gull
3. Laughing Gull
4. Snowy Egret
   Louisiana Heron
   White-faced Ibis
5. Cattle Egret
   Snowy Egret
   Black-crowned Night Heron
   White Ibis
6. Little Blue Heron
   Cattle Egret
   Snowy Egret
   White-faced Ibis
7. Great Blue Heron
   Cattle Egret
   Snowy Egret
8. Laughing Gull
9. Great Blue Heron
   Cattle Egret
   Snowy Egret
   Black-crowned Night Heron
10. Reddish Egret
    Louisiana Heron
    White-faced Ibis
    Sooty Tern
11. Louisiana Heron

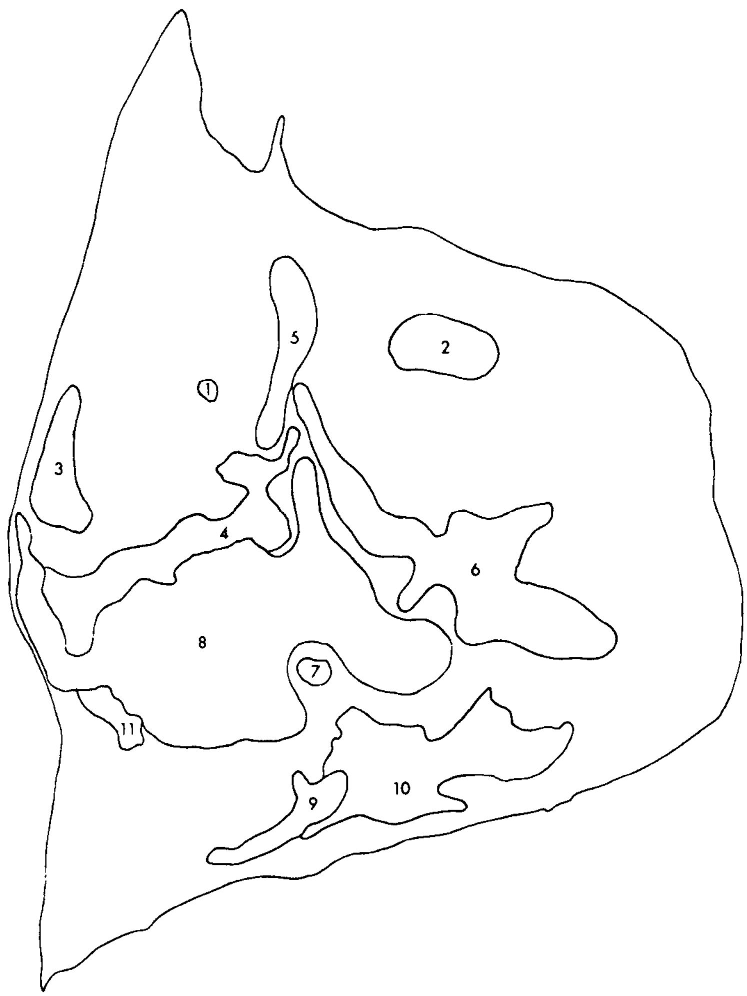


Figure 25. Location and species composition of nesting bird colonies on Island LM 57A.

but their development was not followed.

132. Most of the bird populations were similar to what they had been in past years. There was a reduction of 2500 in the number of Laughing Gulls which could have been due to inexperience in estimating large numbers of birds by two different counting parties. The eastern mound where 4500 Royal and Sandwich Terns nested in 1973 has not been used by either species since that time. Their guano was shown to have induced the growth of *Eragrostis oxylepis* the following year (Mendoza 1974, Ortiz 1974) and could be the reason for their absence in following years. With the clearing of the present vegetation or the deposit of a small new mound of dredged material they might be enticed to return in future years.

LM 63A

133. This long thin island was constructed, as were all the others in this chain, between 24 April 1947 and 5 March 1948. It was formed as the northern end of a low, thin deposit of material approximately 1127.7 m in length with wider portions at each end and one in the center. The island has evidently been subject to much more erosion by currents and waves than most of the other islands. By 1948 most of the emergent material was gone with only the enlarged southern mass remaining. In 1950 it appeared as only a shoal area but in 1953 deposits were evidently made at the northern end reforming an emergent island. The northern end was again submerged in 1961. Deposits in either 1962, 1966 or 1968 and subsequent erosion have left two emergent islands on the original long deposit, LM 63A at the northern end and LM 65 at the southern end.

134. This was the smallest island studied in the southern area, measuring 0.5 ha with an elevation of 0.9 m. The island was composed of sand and shell with vegetation at the northern end while the southern end was a long barren sand spit (Figure 26). The thicker vegetation of Community 1 located on the northern end was composed of *Borrichia frutescens*, *Ambrosia psilostachya*, *Machaeranthera phyllocephala* and several other less frequent plants. The other areas contained infrequent, scattered grasses and other herbs. With this sparse vegetation it appears

1. *Borrichia frutescens, Ambrosia psilostachya, Machaeranthera phyllocephala, Limonium Nashii, Sesuvium Portulacastrum*

2. *Sporobolus pyramidatus, Sesuvium Portulacastrum, Distichlis spicata, Atriplex arenaria*

■. Pond

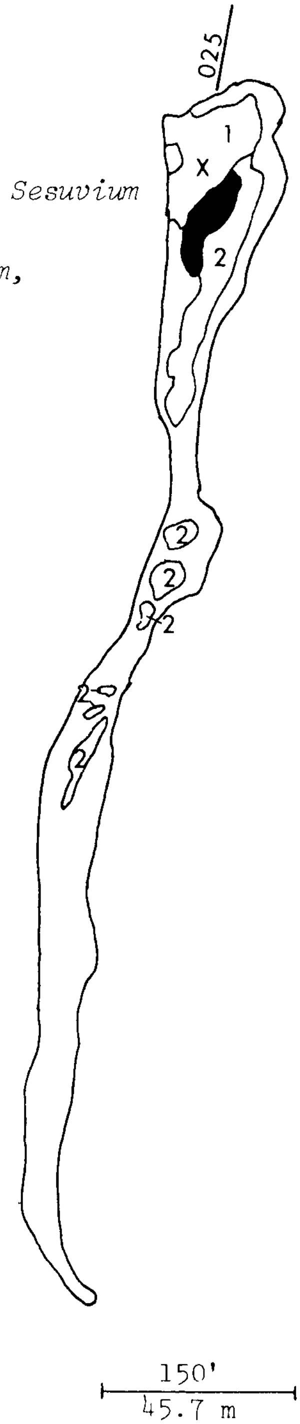


Figure 26. Vegetation communities on Island LM 63A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

that the island will erode away again in the near future.

135. On 4 February approximately 500 Double Crested Cormorants were found to be using the bare southern end as a resting and roosting station. The ground was white with guano and littered with fish bones. Two hundred Ring-billed Gulls and several immature Herring Gulls were also present.

136. Fifty-one adult Black Skimmers and 25 active but empty scrapes were found on 2 May in the higher sand and shell on the southern half of the island. The nests were cup-shaped depressions in coarse shell fragments. They were usually separated from the nearest nest by a distance greater than 61.0 cm (Figure 27). Four nests with a total of 11 eggs were found and marked on 25 May. On 10 June, three additional nests were discovered but on 23 June all nests were empty except one that contained 2 young. On 6 July all marked nests were empty but there were 16 new nests with a total of 35 eggs and 1 young or 2.2 eggs/nest. On 22 July there were 26 nests with 66 eggs and/or young or 2.54 eggs and/or young per nest. The fate of this group of nests is not known.

137. Factors that could possibly have contributed to nesting failures were the disturbance caused by fishermen landing on the island and walking among known active skimmer colonies and the presence of rice rats, *Oryzomys palustris,* although none were seen.

LM 81

138. LM 81 was constructed in a similar fashion, and during the same span of time as LM 63A, 24 April 1947 to 5 March 1948. The original deposit was a long thin one covering the entire deposit area, some 1737.4 m in length. The history of this deposit area has been one of erosion and submergence of the once exposed material. There were few aerial photographs available for this area of the Laguna Madre and the history of this island is incomplete. By 1956, the original long island was reduced to half its original width. The present LM 81 was recognizable as the wider northern end of the long island. There appeared to be scattered communities of vegetation, several bare areas and two small ponds. By 1969, most of the original deposit was gone except for the northern end, the present-day LM 81. To this island new material had

1. Black Skimmer

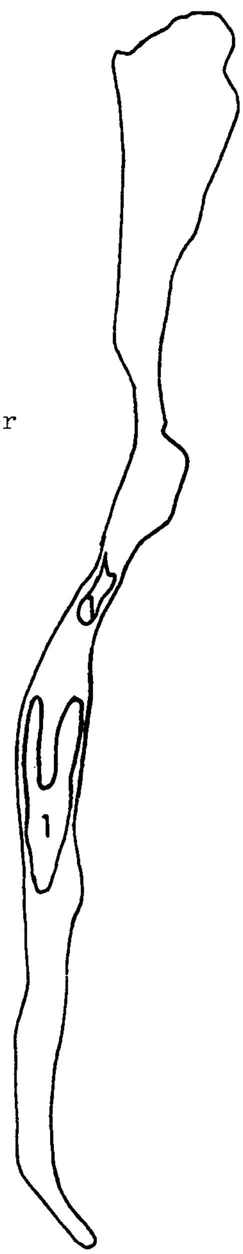


Figure 27. Location and species composition of nesting bird colonies on Island LM 63A.

been added from the dredging of side channels to the south. In 1974, dense vegetation was present and a small shrub grove was visible in the center. Since that date, there have been no further deposits and the general shape of the island has remained unchanged.

139. The island was one of the smaller ones (1.7 ha) and lower ones (1.7 m) studied. It was also one of the most productive in terms of vegetation and birds. Much of the substrate was of large shells of gastropods and pelecypods that were no longer living in the Laguna Madre or that part of it. The crown of the island contained rocks from serpulid reefs. The presence of the larger material was probably what has kept the island from eroding away as has the southern part of the original deposit. Unlike most of the other islands there were no signs of rodents but in some areas there were bare mounds of soil indicating the presence of ants.

140. The crown of the island, located near the eastern shore contained sparse vegetation of *Sporobolus pyramidatus*, *Cenchrus incertus* and *Aster sublatus* (Figure 28). At lower elevations in the center of the island there was a dense stand of very lush *Baccharis neglecta*. The bushes were 2-3 m in height and covered 100 percent of the area (Appendix F). Evidently, conditions were good in the past for the germination and growth of the wind-blown seeds of this "pest" plant species. The lushness was probably, in part, due to the fertilizing effect of the droppings of the nesting birds in past years. The other plant communities surrounding the stand of *B. neglecta* contained scattered bushes of this species. Around these communities there were areas containing thick growths of *Borrichia frutescens*, *Lycium carolinianum*, *Ambrosia psilostachya* and *Gaillardia pulchella*. Surrounding all was a thin strip of the typical usual halophytes.

141. This island was nested upon by a greater variety of bird species (12) than any of the other islands in the southern area. There were 6 nests of Great Blue Herons, 3 nests of Little Blue Herons, 12 nests of Great Egrets, 25 nests of Snowy Egrets and 90 nests of Cattle Egrets in the *B. neglecta* (Figure 29 and Appendix I). The White-faced Ibises, the Reddish Egrets and the Louisiana Herons nested in the lower stands of

1. *Baccharis neglecta*
2. *Baccharis neglecta, Lycium carolinianum, Ambrosia psilostachya*
3. *Borrichia frutescens, Ambrosia psilostachya, Lycium carolinianum*
4. *Sporobolus pyramidatus, Cenchrus incertus, Aster sublatus, Oenothera Drummondii*
5. *Baccharis neglecta, Cynodon Dactylon, Ambrosia psilostachya*
6. *Sporobolus pyramidatus, Sesuvium Portulacastrum, Conyza canadensis*
7. *Gaillardia pulchella, Ambrosia psilostachya, Sesuvium Portulacastrum*
8. *Paspalum vaginatum, Suaeda linearis, Solanum americanum, Sesuvium Portulacastrum*
9. *Suaeda linearis, Sporobolus pyramidatus, Salicornia Bigelovii, Atriplex arenaria*
10. *Sporobolus pyramidatus, Borrichia frutescens, Heliotropium curassavicum, Salicornia Bigelovii, Limonium Nashii*

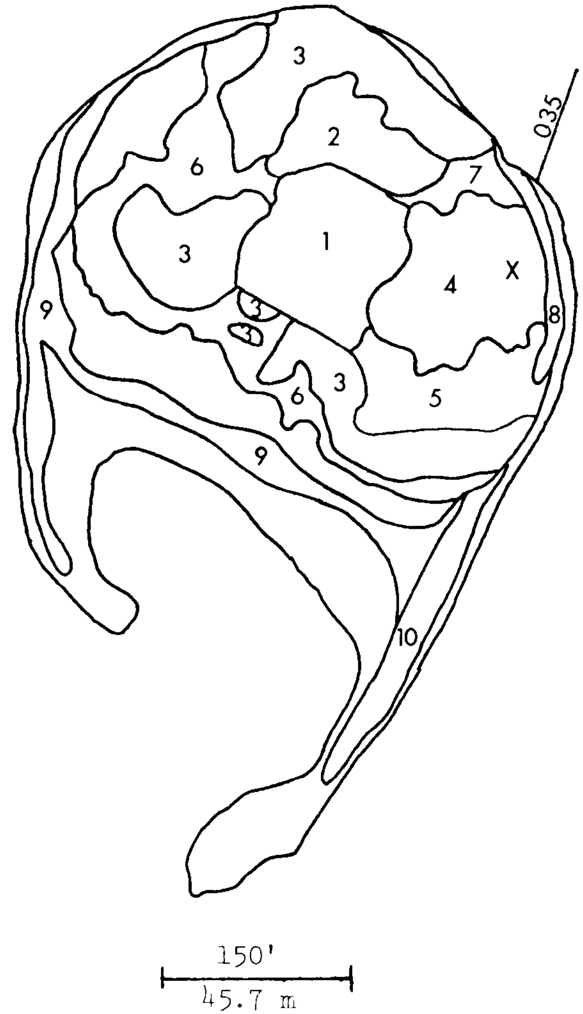


Figure 28. Vegetation communities on Island LM 81. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Caspian Tern
   Black Skimmer
2. Little Blue Heron
   Reddish Egret
   Louisiana Heron
3. Louisiana Heron
   White-faced Ibis
4. Great Blue Heron
   Little Blue Heron
   Cattle Egret
   Great Egret
   Snowy Egret
5. Gull-billed Tern
   Black Skimmer
6. Laughing Gull
7. Reddish Egret
   Louisiana Heron
   White-faced Ibis

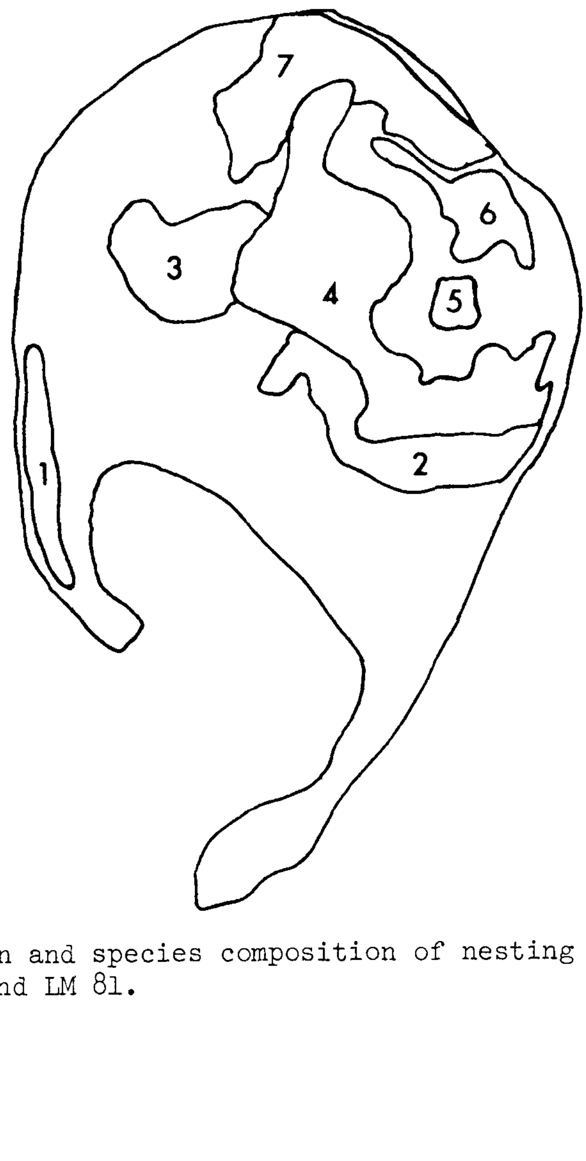


Figure 29. Location and species composition of nesting bird colonies on Island LM 81.

B. frutescens and *L. carolinianum*. The Caspian Tern nests and Black Skimmer nests were found in a bare sandy area on the western shore. Black Skimmers also nested in the area of sparse vegetation near the apex along with Gull-billed Terns and Laughing Gulls. The results of nesting of all species can be found in Appendix I.

142. The success of the birds on this island was probably high, although analysis of the data does not indicate this. The birds were so concentrated in such a small, densely vegetated area that the taking of accurate data was impossible. If the island were not under the protection of the Padre Island National Seashore and "off limits" to everyone during the nesting season, nesting success would be very low. The birds were greatly disturbed when the research crew approached the island and many small chicks may have perished when they fled from nests during counts by the crew.

LM 105

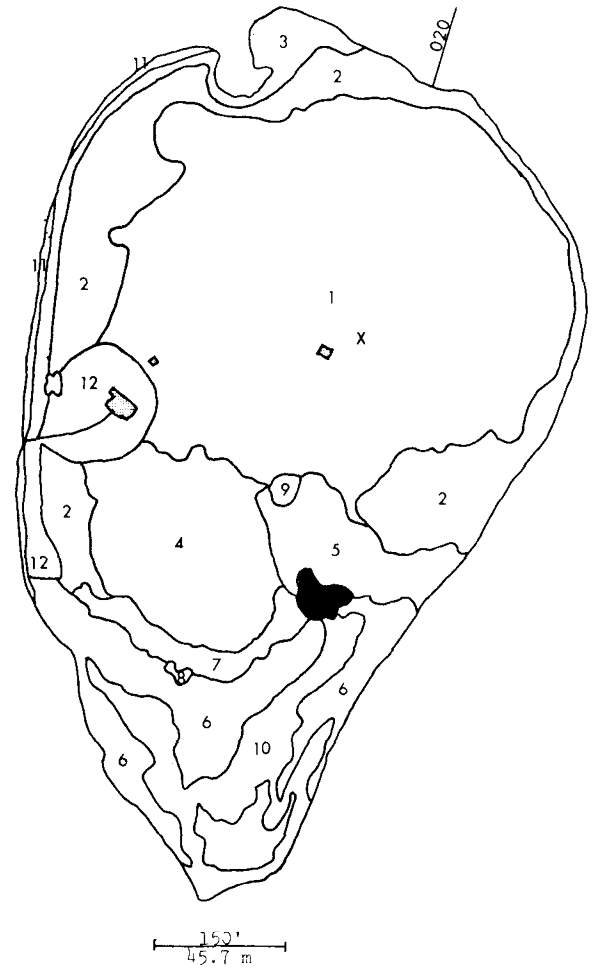
143. This island is one of six islands located on the eastern side of the GIWW at the mouth of Baffin Bay (Appendix B). All were formed between 24 April 1947 and 5 March 1948. This island was formed as an oval tear-shaped land mass, the result of a larger deposit to the north and a smaller one to the south. In 1950, there was little change in the appearance of the island. There was little or no vegetation and some new material may have been deposited between May and June of 1950 since the area was scheduled for maintenance at that time. The result of a single deposit, probably made in 1953, on the southeastern portion of the island between the two original deposits was visible in 1956. A large deep pit and channel were formed by the force of the discharge. Most of the effluent followed the channel back to the water and filled the area between this and island LM 107. There was some marginal vegetation and a dense growth around the pit and along the channel. In 1961 there was evidence of further deposits on each end of the island and a small deposit into the 1953 pit. Again, the material flowed back into the water and the island was connected to LM 103 and LM 107 at each end. The vegetation was thicker around the pit and channel and there was

some vegetation on the slopes of the mound. A house and pier were constructed just prior to 1961. There was little other change until 1970 when two small deposits were made between 2 April and 22 June 1970. One deposit was made at the north end near the island margin and the other into the pit that was formed in 1953. Again, most of the material ran back into the water. These deposits were made during the nesting season and washed 12 Great Blue Herons nests, eggs, and young away (Barnes 1971, Simersky 1971). In 1970 and 1971 the island, its soils, vegetation and nesting birds were examined by Barnes (1971), Simersky (1971) and McMurray (1971). The lower areas of the island were densely covered with vegetation including most of the smaller crown. The large crown still contained little vegetation. There was little change in 1974 and by 1976 there was more vegetation on the large crown.

144. The island was 4.2 ha in size and the high point was located at the apex of the old crown and was 3.0 m above sea level. The substrate was made up of fine sand, small and large shells and large pieces of old serpulid reefs, especially on the crown.

145. The vegetation has changed little since the time that it was described by Barnes (1971) and DePue (1974). The crown has remained rather bare consisting of scattered clumps of *Heterotheca subaxillaris, Hedyotis nigricans, Chloris petraea* and *Sporobolus asper* (Figure 30). The lower slopes and base of the crown were densely vegetated with the characteristic vegetation of this type of area on the older islands (Appendix F). The *Borrichia frutescens* on the southern end of the island was thick, but not as dense as that on LM 57A. There was a small stand of *Tamarix ramosissima* and a fresh water pond containing a *Typha domingensis* community.

146. Most of the birds nested on the southern end of the island in the dense *B. frutescens* community. The birds that nested there were the same species that nested in this type of community on the other islands: Snowy Egrets, Reddish Egrets, Louisiana Herons and White-faced Ibises. A single Black-crowned Night Heron nest was found in the cattails around the fresh water pond (Figure 31). Laughing Gulls nested in a *Sporobolus virginicus* community interspersed among the *B. frutescens*.



1. *Heterotheca subaxillaris, Hedyotis nigricans, Chloris petraea, Sporobolus asper, Baptisia leucophaea, Asclepias oenotheroides*
2. *Andropogon glomeratus, Paspalum monostachyum, Ambrosia psilostachya, Samolus ebracteatus*
3. *Paspalum vaginatum, Borrichia frutescens, Lycium carolinianum, Limonium Nashii*
4. *Heterotheca subaxillaris, Phyla incisa, Ambrosia psilostachya, Hedyotis nigricans*
5. *Paspalum vaginatum, Ambrosia psilostachya, Borrichia frutescens*
6. *Borrichia frutescens, Machaeranthera phyllocephala, Sesuvium Portulacastrum, Limonium Nashii*
7. *Sporobolus virginicus, Ambrosia psilostachya, Heterotheca subaxillaris*
8. *Tamarix ramosissima*
9. *Typha domingensis, Eleocharis montevidensis*
10. *Suaeda linearis, Sesuvium Portulacastrum, Monanthochlöe littoralis, Salicornia virginica, Sporobolus pyramidatus*
11. *Suaeda linearis, Salicornia Bigelovii*
12. *Calylophus australis, Chloris petraea, Indigofera miniata, Aristida intermedia*

Buildings

Pond

Figure 30. Vegetation communities on Island LM 105. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Gull-billed Tern
   Black Skimmer
2. Gull-billed Tern
   Black Skimmer
3. Snowy Egret
4. Reddish Egret
   Snowy Egret
   Louisiana Heron
   White-faced Ibis
5. Laughing Gull
6. Reddish Egret
   Louisiana Heron
   Laughing Gull
7. Black-crowned Night Heron

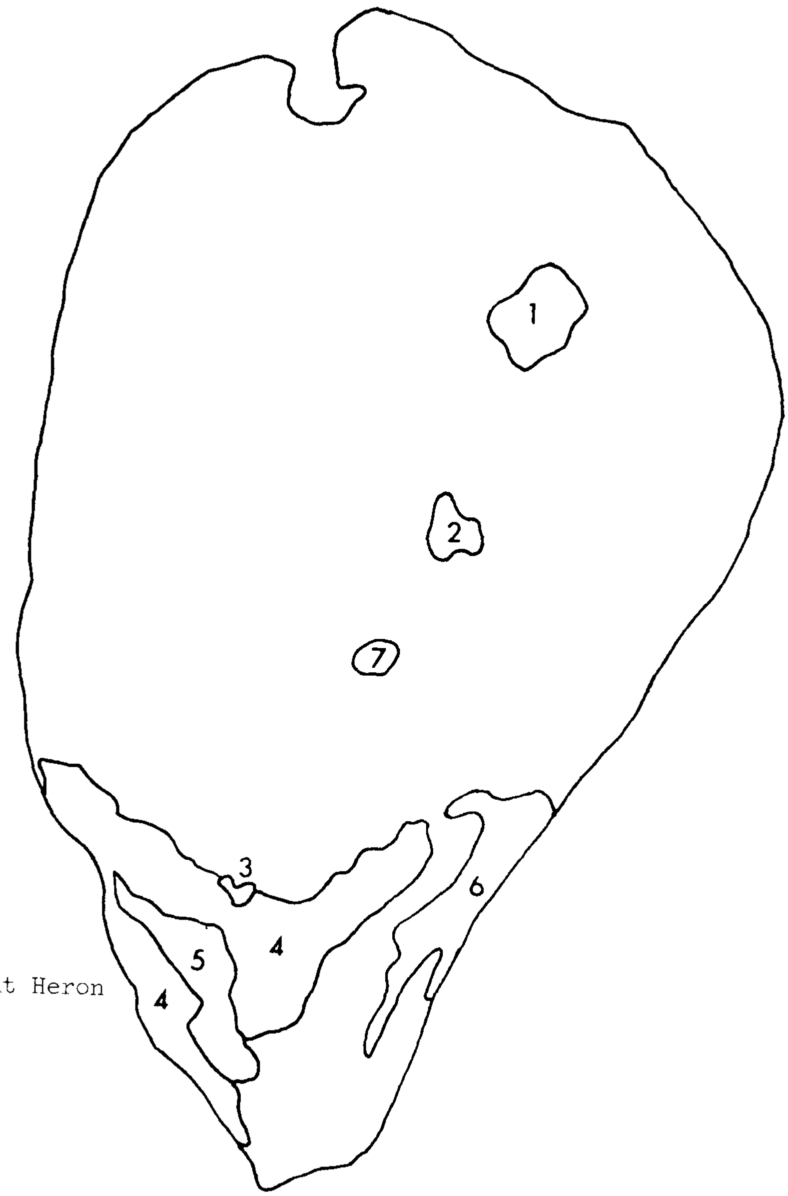


Figure 31. Location and species composition of nesting bird colonies on Island LM 105.

Gull-billed Terns and Black Skimmers nested in two small areas on the sparsely vegetated crown.

147. There was an increase in the numbers of birds of each species that nested on the vegetation on this island in 1977 relative to 1976. The more significant increases were the 114 Snowy Egret nests and the addition of 41 pairs of White-faced Ibises. The number of nesting pairs of Reddish Egrets has declined steadily since 1970. This year, 1977, was no exception since only five pairs used the island. There was a decrease in the number of ground nesters and this could have been caused by the increased amount of vegetation on the barer areas of the island.

148. The islands in this series have had a long history of nesting birds, probably dating back to the 1950's when vegetation began to appear on them. Although unsubstantiated, there are verbal reports that there was once a large heronry on the mainland at the northern point (Point of Rocks) where Baffin Bay joins the Laguna Madre. Predator pressure was said to have caused the abandonment of this nesting site. The birds did not move to the nearer islands on the western side of the GIWW because they are much more elevated islands and the substrate is mostly serpulid reef rocks. This would not have been conducive to the development of the thick growths of *B. frutescens* in which the birds now nest.

LM 109

149. The origin and development of this island was similar to the preceding one. It was also formed into a tear shape and was connected to LM 111 by a deposit made between these two islands in 1953. In 1956 there was little evidence of vegetation except on the southern end and in the erosion channels on the central crown. By 1961 there was a large house and four small poultry houses present on the western part of the island. Small deposits, most of which ran back into the water, were made in 1963, 1967 and 1968. In 1970 a small grove of trees was present on the central crown in a depression resulting from the original deposit. The sides and crown of the island contained little vegetation. Simersky (1971) described 2 large clusters and several isolated *Prosopis* trees

near the center of the island. The predominant plant on the slopes of the mound was *Baptisia leucophaea,* and *Borrichia frutescens* was near the shore. The fresh water pond that was present on the island was filled with dredged material during the 1970 nesting season.

150. There was little change in 1976. *Nerium Oleander* was present around the houses and the houses were deteriorating since no one was using them.

151. The island was 2.6 ha in size and was elevated to 2.3 m in the center of the crown among the *Prosopis glandulosa* trees. The substrate was similar to that of LM 105 but not as rocky. There were two ponds present on the eastern side, the result of two depositional scars made in past years.

152. Other than the dense stand of *Prosopis glandulosa* surrounded by a thick growth of *Cenchrus ciliaris, Ambrosia psilostachya, Opuntia Lindheimeri* and *Lantana Camara* on the crown of the island, the vegetation was like that of the other thirty-year-old islands (Figure 32).

153. Approximately 250 pairs of Great Blue Herons, Snowy Egrets and Cattle Egrets nested in the *Prosopis glandulosa* on the crown of the island (Figure 33). They took advantage of these trees for years, and the island had become one of the more important ones in terms of Great Blue Heron nesting in the northern Laguna Madre. There were other birds that nested primarily in the *Borrichia frutescens* on the northern and southern ends of the island (Figure 33). They were Reddish Egrets, Louisiana Herons and Laughing Gulls. It was almost impossible, as on LM 81, for the field crew to obtain any accurate data for those birds nesting in the trees. The adults flew and remained overhead, the young regurgitated their food, and walked, fell or jumped from their nests if the nesting sites were approached. If the departing youngster was an almost fledged Great Blue Heron, it destroyed other nests, kicked young from nests or knocked eggs to the ground. Efforts were made to avoid disturbing the birds on this island by limiting field trips and not approaching the trees too closely if a landing was made. Unfortunately, the research crew was not the only one that disturbed the birds. A new group of cabin owners decided that they would occupy the old buildings, but first the structures

1. *Prosopis glandulosa, Opuntia Lindheimeri, Lantana Camara*
2. *Cenchrus ciliaris, Ambrosia psilostachya, Borrichia frutescens, Lantana Camara*
3. *Heterotheca subaxillaris, Sporobolus virginicus, Chloris petraea, Sporobolus cryptandrus, Indigofera miniata*
4. *Heterotheca subaxillaris, Ambrosia psilostachya, Sporobolus virginicus, Borrichia frutescens*
5. *Borrichia frutescens, Paspalum vaginatum, Sesuvium Portulacastrum*
6. *Batis maritima, Suaeda linearis, Sesuvium Portulacastrum, Lycium carolinianum*
7. *Machaeranthera phyllocephala, Distichlis spicata, Limonium Nashii*
8. *Monanthochlöe littoralis, Borrichia frutescens, Batis maritima, Lycium carolinianum, Limonium Nashii*
9. *Monanthochlöe littoralis, Salicornia Bigelovii, Salicornia virginica*
10. *Hedyotis nigricans, Machaeranthera phyllocephala, Borrichia frutescens, Limonium Nashii*

○○○. *Nerium Oleander, Prosopis glandulosa, Salix nigra*

▩. Buildings

■. Ponds

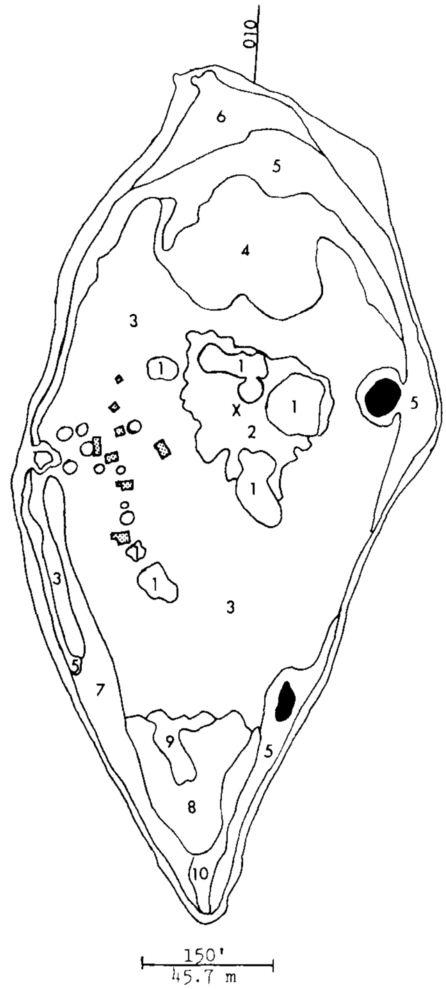


Figure 32. Vegetation communities on Island LM 109. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Reddish Egret
Louisiana Heron
Laughing Gull

2. Cattle Egret
Snowy Egret

3. Great Blue Heron
Cattle Egret
Snowy Egret

4. Great Blue Heron
Cattle Egret
Snowy Egret

5. Great Blue Heron
Cattle Egret
Snowy Egret

6. Cattle Egret
Snowy Egret

7. Reddish Egret
Louisiana Heron
Laughing Gull

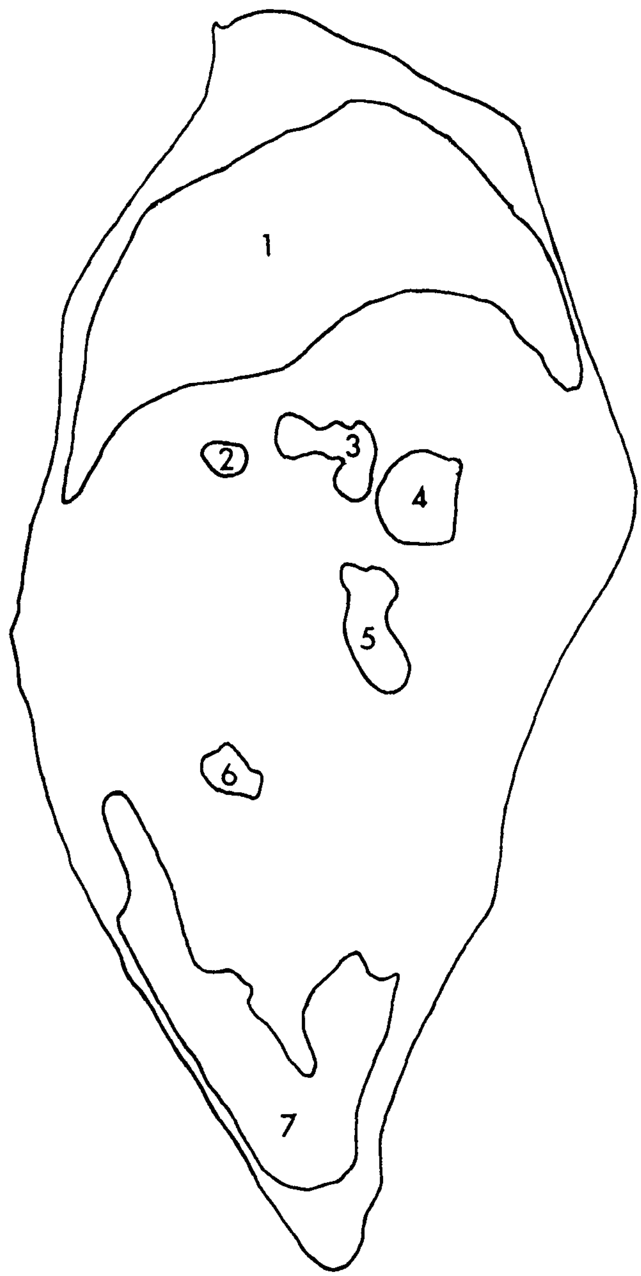


Figure 33. Location and species composition of nesting bird colonies on Island LM 109.

needed to be rebuilt and the area cleaned. These activities, including trimming trees in which there were nest platforms, were conducted at the peak of the nesting season. People on adjacent islands reported that the adult birds were in the air over the island continually for days at a time. There is little doubt that the birds on this island achieved little or no success in their nesting efforts.

LM 111

154. This island was selected for study because it supported nesting birds in spite of the presence of several cabins owned by a very active group of sport fishermen. The history of the island was very similar to that of LM 109. Small deposits of dredged material were made at scheduled maintenance dredging times and most of the material ran back into the water as on the other islands. By 1961 there was one house and pier and by 1967 there were two additional houses, all on the western side. By 1974 the island was covered with vegetation and another pier was present on the eastern side.

155. In 1976 the island was 3.4 ha in area and elevated to 2.7 m. The substrate was similar to that of LM 109 and the vegetation similar to that of LM 105 (Figure 34). There were no *Borrichia frutescens* dominated communities. Instead the area contained greater and more frequent amounts of *Machaeranthera phyllocephala* and scattered plants of *B. frutescens* (Appendix F).

156. Although over half the island was influenced and disturbed by the cabin owners and guests, 9 pairs of Louisiana Herons and 25+ pairs of Laughing Gulls nested in the *M. phyllocephala* and *B. frutescens* on the southern end of the island (Figure 35). Both species hatched and fledged young (Appendix I). Two nests of Black Skimmers and three nests of Gull-billed Terns were found on the southern slope of the central mound. None of these nests were successful. They were situated near a path that led from the cabins to the pier on the eastern side.

157. One unusual aspect in relation to this island was the attitude of the cabin owners toward the birds. They had established a set of rules which protect, to a certain extent, the nesting birds. For

1. *Heterotheca subaxillaris, Hedyotis nigricans, Sporobolus asper, Baptisia leucophaea, Gaillardia pulchella*
2. *Machaeranthera phyllocephala, Fimbristylis castanea, Iva angustifolia*
3. *Sporobolus virginicus, Chloris petraea, Baptisia leucophaea, Hedyotis nigricans*
4. *Calylophus australis, Chloris petraea, Gaillardia pulchella, Hedyotis nigricans*
5. *Hedyotis nigricans, Machaeranthera phyllocephala, Ambrosia psilostachya*
6. *Andropogon glomeratus, Paspalum vaginatum, Ambrosia psilostachya, Erigeron myrionactis*
7. *Paspalum vaginatum, Borrichia frutescens*
8. *Machaeranthera phyllocephala, Sporobolus virginicus, Borrichia frutescens, Limonium Nashii, Iva angustifolia*
9. *Batis maritima, Lycium carolinianum, Borrichia frutescens, Sesuvium Portulacastrum*
10. *Sporobolus virginicus, Ambrosia psilostachya, Indigofera miniata*
11. *Eleocharis montevidensis*

▩. Buildings

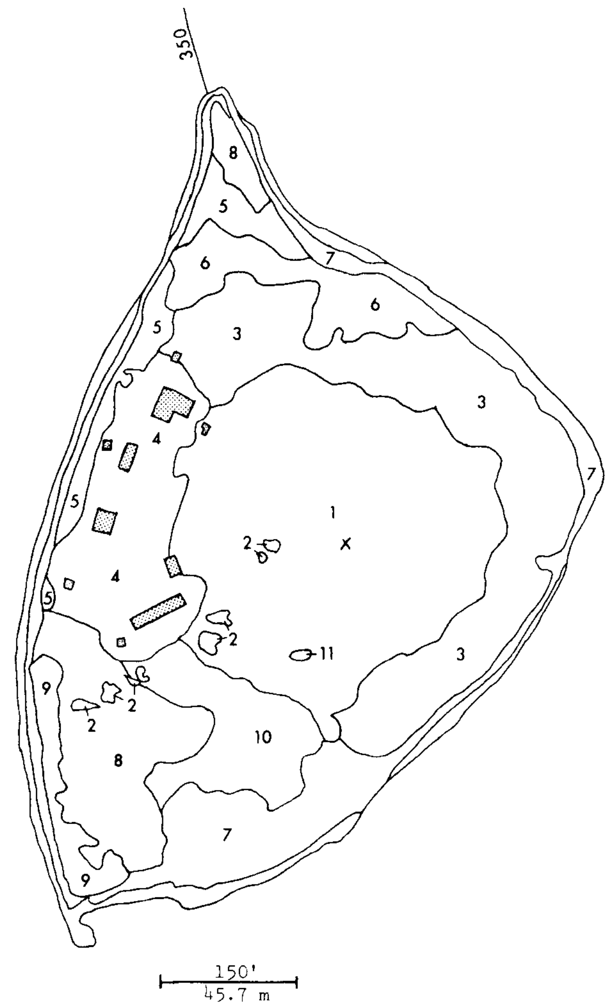


Figure 34. Vegetation communities on Island LM 111. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

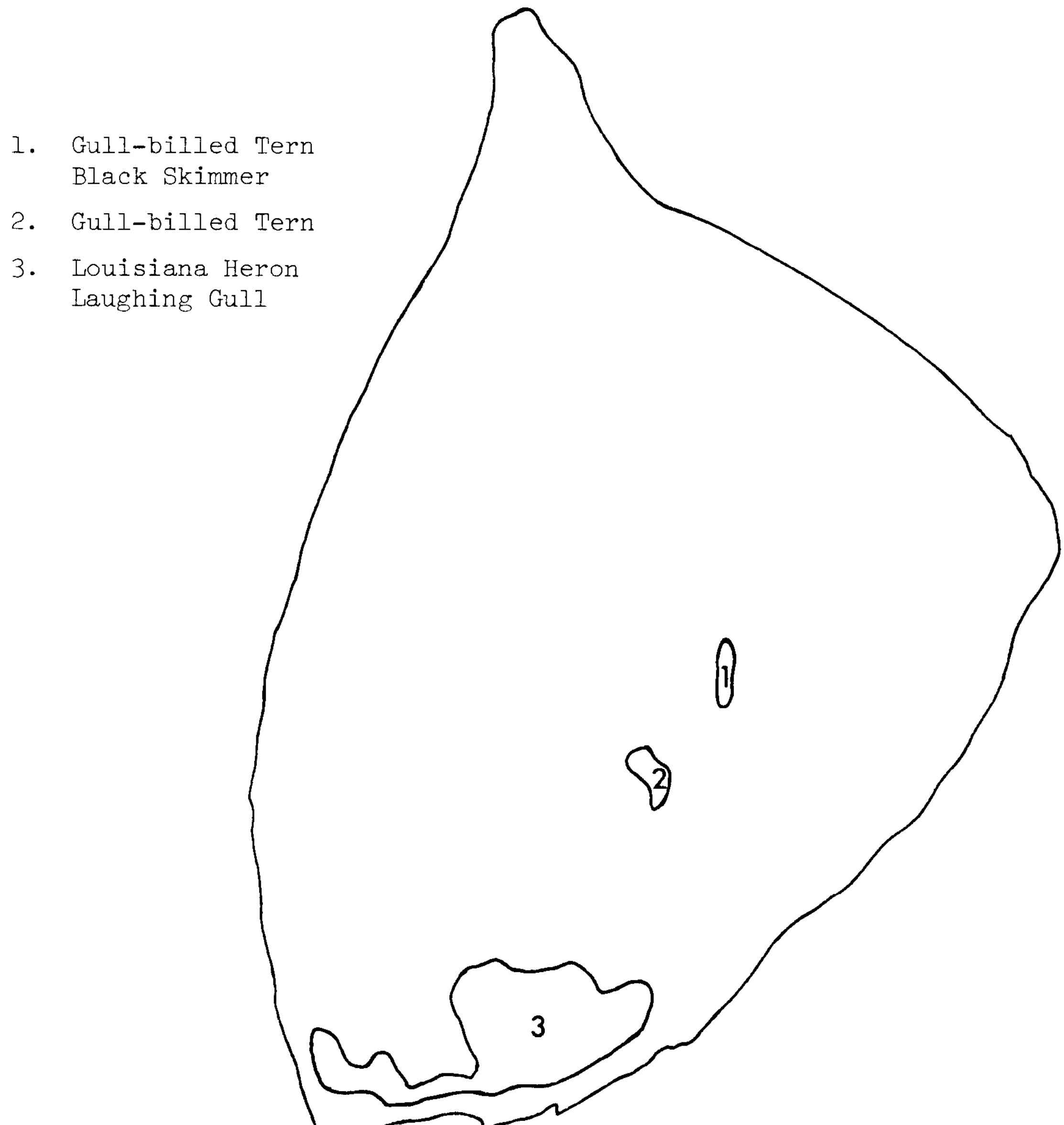


Figure 35. Location and species composition of nesting bird colonies on Island LM 111.

example, no dogs were allowed, children's activities were supervised, no one was permitted in the nesting area, and activities on the island were restricted, especially during the heat of the day. It was proven possible to have birds and people on the same island.

Northern Study Area Islands

Houston Ship Channel Islands

158. The first record of dredging on the Houston Ship Channel (HSC) dates to 1872 when a channel was cut through Red Fish Reef Bay (Richardson 1950). In 1880 a channel, 3.6 m deep and 30.5 m wide was completed from Bolivar Roads to Red Fish Reef. By 1892 a narrower 22.9 m channel was extended from Red Fish Reef to Morgan's Point. In 1899 the City of Houston secured Congressional approval to deepen the existing channel to 5.6 m and extend the channel at that depth to the Port of Houston. The 101.9-km-long channel was deepened to 9.1 m in 1925 and to 11.0 m in 1935. The present authorized depth of the HSC is 12.2 m.

159. It seems likely that the majority of the dredged material islands along the HSC date back to the 1899 deepening project. As the channel was subsequently deepened and widened, additional material was added to the existing islands. For example, a 1931 map of Galveston Bay (U.S. Coast and Geodetic Survey Map No. 1282) showed a large island east of the HSC extending from mid-Scott Bay north to mid-Crystal Bay. By 1961, the large island had become much narrower due to erosion. An aerial photo taken in 1964 for the Soil Conservation Service showed that the island had eroded away near the center to form two islands. In 1977 further erosion had reduced the two land masses to four islands in Scott Bay.

160. Farther down the channel, Hogg Island and Atkinson Island were used as dredged material deposition sites. A causeway was built during the 1950's across Tabb's Bay to Hogg Island and a dock-refinery complex was constructed. Atkinson Island remained isolated and continued to serve as a disposal site. In 1966 a mooring channel spur was dredged from the HSC through a portion of Atkinson Island. As a result, a long

island was left to serve as a wave-buffer between the mooring channel and the HSC. The buffer island, called Sub-Atkinson Island, eroded into two parts soon after its construction and the two islands were referred to in this study as North and South Atkinson Islands.

161. The history of the remaining dredged material island along the HSC, Bulkhead Reef, remained unknown. In mid-Galveston Bay, Red Fish Island occurred where the HSC cuts through the Red Fish Reef. Apparently this island was a natural island to which dredged material was added.

162. Five of the islands along the HSC were selected for detailed study: Scott Bay #2 and #3, the two southernmost islands of the four exposed Scott Bay Islands, North and South Atkinson Islands, and Bulkhead Reef (Appendix B).

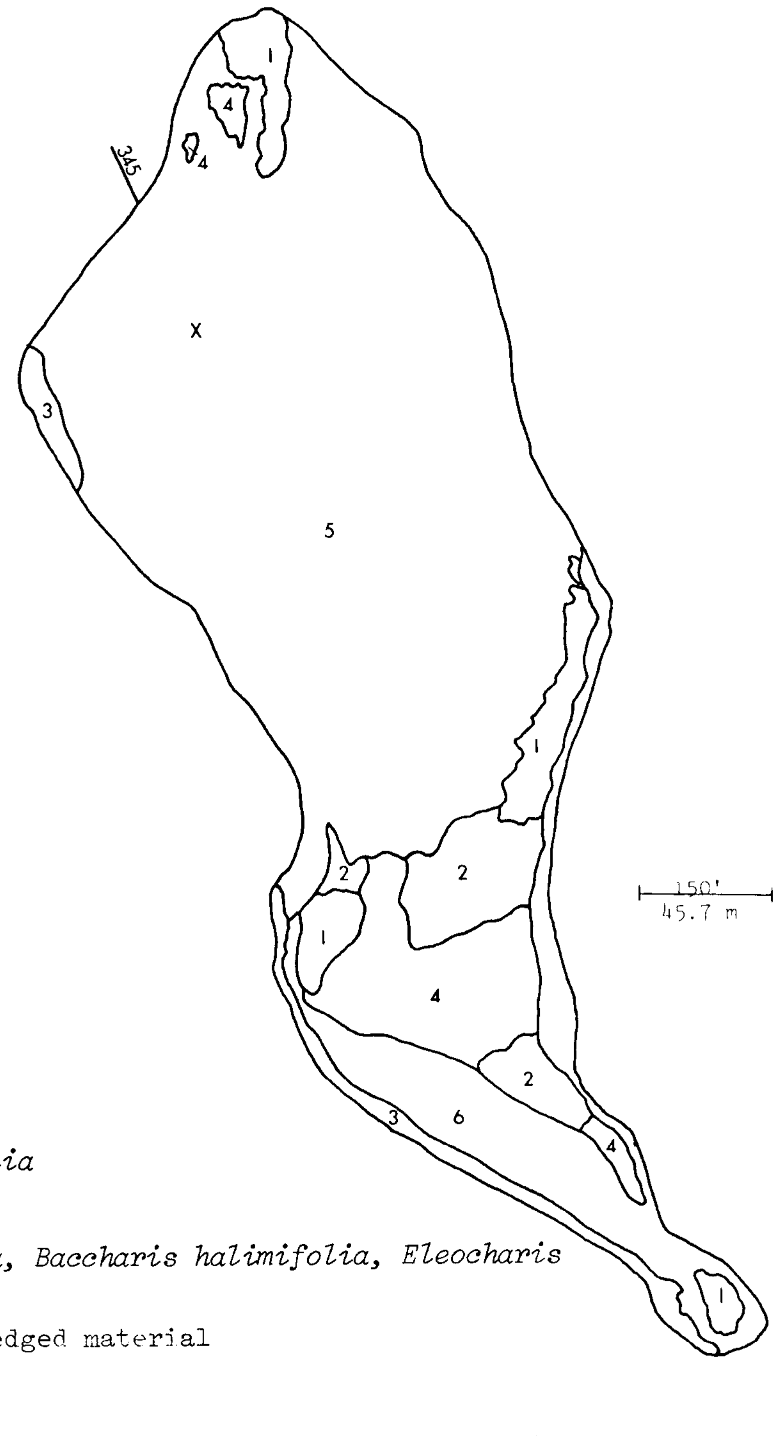
163. Scott Bay Island #2 (HSC 116). Scott Bay Island #2 was the only island in the northern specific study area with recent dredged material. A dredged material deposit was made on the island in early 1976. The material, deposited in a cone in the center of the island, consisted of a yellowish-red clay. Existing vegetation communities on the southern end of the island and a small area on the northern end were not altered by the deposition.

164. Bushy growths of *Rosa bracteata* occurred on the undisturbed portions of the island and stands of *Baccharis halimifolia* were found on the southern end. A mixed association of *Eleocharis* sp., *Medicago polymorpha,* and *B. halimifolia* grew in low, moist areas.

165. When visited in January 1977, the center of the island was devoid of vegetation but by August, the area of fresh dredged material deposition was covered with a mixed association consisting mainly of *Sesbania Drummondii,* which had reached a height of 0.6 - 1.2 m. The understory consisted of many species, none common, that were normally associated with mesic coastal areas. These species included *Teucrium cubense, Medicago polymorpha* and *Cynodon Dactylon* (Figure 36).

166. No colonial wading birds nested on Scott Bay Island #2 in 1977 and there was no evidence of nesting in 1976.

167. Scott Bay Island #3 (HSC 118). Scott Bay Island #3 represented a very old island with undisturbed, mature vegetation. The soil contained



1. *Rosa bracteata*
2. *Baccharis halimifolia*
3. Rock Bulkhead
4. *Medicago polymorpha, Baccharis halimifolia, Eleocharis* sp.
5. Newly deposited dredged material
6. Sand

Figure 36. Vegetation communities on Island HSC 116. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

much organic matter and was composed primarily of sand. Reddish clay was exposed along some of the steep banks adjacent to the HSC.

168. The most abundant plant on the island was *Rosa bracteata*. It occurred in a monospecific stand on the northwestern corner of the island and grew as a vine covering the tree community (Figure 37). The tree community consisted of a *Celtis Lindheimeri* and *Zanthoxylum Clava-Herculis* association. These trees were from 2.4 to 3.6 m tall and occurred on the southwestern corner of the island. A dense stand of *Arundo Donax* grew on the eastern side of the island. The understory was variable and included associations of *Sesuvium Portulacastrum, Lepidium austrinum, Ampelopsis arborea* and *Plantago Hookeriana*.

169. Two colonies of several species of wading birds nested on Scott Bay #3, one in the *Rosa bracteata* thicket on the northern end of the island and the other in the *Celtis-Zanthoxylum-Rosa* association on the southern end (Figure 38). Great Egrets, Great Blue Herons, Louisiana Herons, Black-crowned Night Herons, and Roseate Spoonbills nested in the trees. Cattle Egrets tended to nest in the rose brambles by hollowing out an opening in the side of the brambles and constructing a nest. Snowy Egrets nested most commonly in *Opuntia Lindheimeri* clumps in the understory of these communities.

170. Nesting success as reflected by hatching success was low on this island (Appendix I). This was due, in part, to a high population of fire ants, *Solenopsis invicta* Buren, throughout the island. As a young bird began to pip the egg, multitudes of ants would swarm through the opening into the cavity. In many cases the young bird was killed before it could completely emerge from the shell. The establishment of regularly traversed transects through the island seemed to increase the distribution of fire ants. As the vegetation was trampled on the census lines, large fire ant mounds were constructed in the barren pathways. Since the pathways were immediately adjacent to bird nests, this may have increased the effect of fire ants on the survival of avian young.

171. HSC 90. This was the northernmost of the two islands created when the mooring channel was cut into Atkinson Island. North Atkinson Island has not had any additional dredged material placed upon it since

1. *Rosa bracteata*
2. *Zanthoxylum Clava-Herculis, Celtis Lindheimeri, Rosa bracteata*
3. *Arundo Donax*
4. *Baccharis halimifolia, Rosa bracteata, Rubus trivialis*
5. *Sesuvium Portulacastrum*
6. *Conyza canadensis, Lepidium asutrinum, Plantago Hookeriana*
7. *Lepidium austrinum, Plantago Hookeriana, Machaeranthera phyllocephala, Ampelopsis arborea, Rosa bracteata*
8. Sand

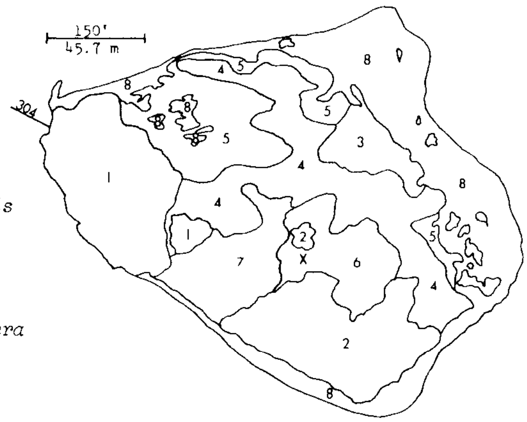


Figure 37. Vegetation communities on Island HSC 118. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Cattle Egret
   Snowy Egret
   Louisiana Heron
   Black-crowned Night Heron
   Great Egret
   Roseate Spoonbill
   Great Blue Heron

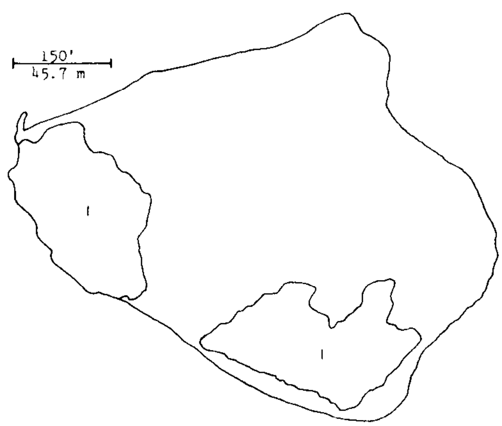


Figure 38. Location and species composition of nesting bird colonies on Island HSC 118.

before 1966. From examination of an aerial photograph taken in 1961, it appeared that at least a portion of the area was covered with fresh dredged deposits during that year. The soils of the islands were composed primarily of sand but the high banks that surrounded the island also contained *Crassostrea virginica* (Gmelin) and *Rangia cuneata* (Sowerby) shells.

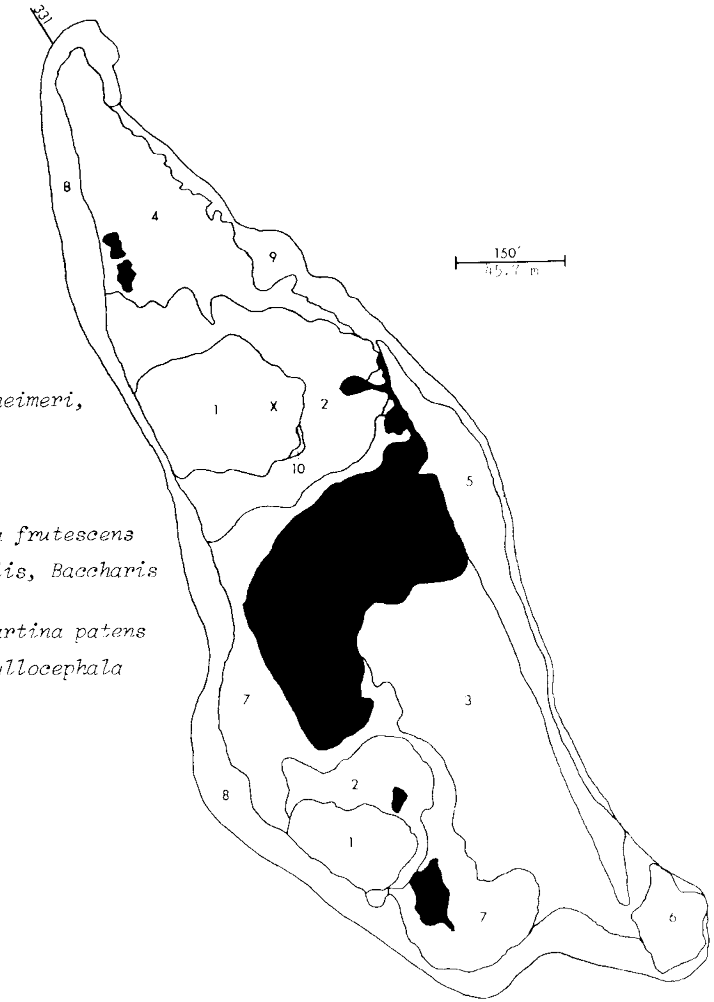
172. There was a near-permanent pond of salt water in the center of the island and ships passing down the HSC send high bow waves crashing over the lower portions of the island and into the pond. There were four other small impoundments present but these contained freshwater (Figure 39).

173. There were two tree communities, one on either end of the island, composed of *Celtis Lindheimeri* and *Zanthoxylum Clava-Herculis*. Most of the remainder of the island was covered by a *Baccharis halimifolia* community. In some areas *Iva frutescens* was interspersed with the *B. halimifolia*. Areas of low, salt-tolerant vegetation surrounded the saline pond and occurred on the low, southern end of the island. *Salicornia Bigelovii* was the most abundant plant on the periphery of the pond, but it was interspersed with *Borrichia frutescens* as the distance from the pond increased. *Spartina patens* and *Iva frutescens* grew on the low end of the island.

174. The two mixed wading bird colonies on the island were both located in *Celtis-Zanthoxylum* associations (Figure 40). The pattern of nesting was the same as discussed elsewhere. Olivaceous Cormorants nested in the highest portions of the trees while the other seven species nested throughout the remainder of the suitable habitat. The colonies on this island were very successful in fledging young (Appendix I).

175. <u>HSC 88.</u> With the exception of the absence of tree communities, the vegetation of South Atkinson Island was similar to that found on the previous island (Figure 41 and Appendix F). Other exceptions included the presence of *Tamarix africana* as isolated individuals near the center of the island and the presence of a large area of *B. halimifolia* and *B. frutescens*.

176. No colonial wading birds nested on this island in 1977.



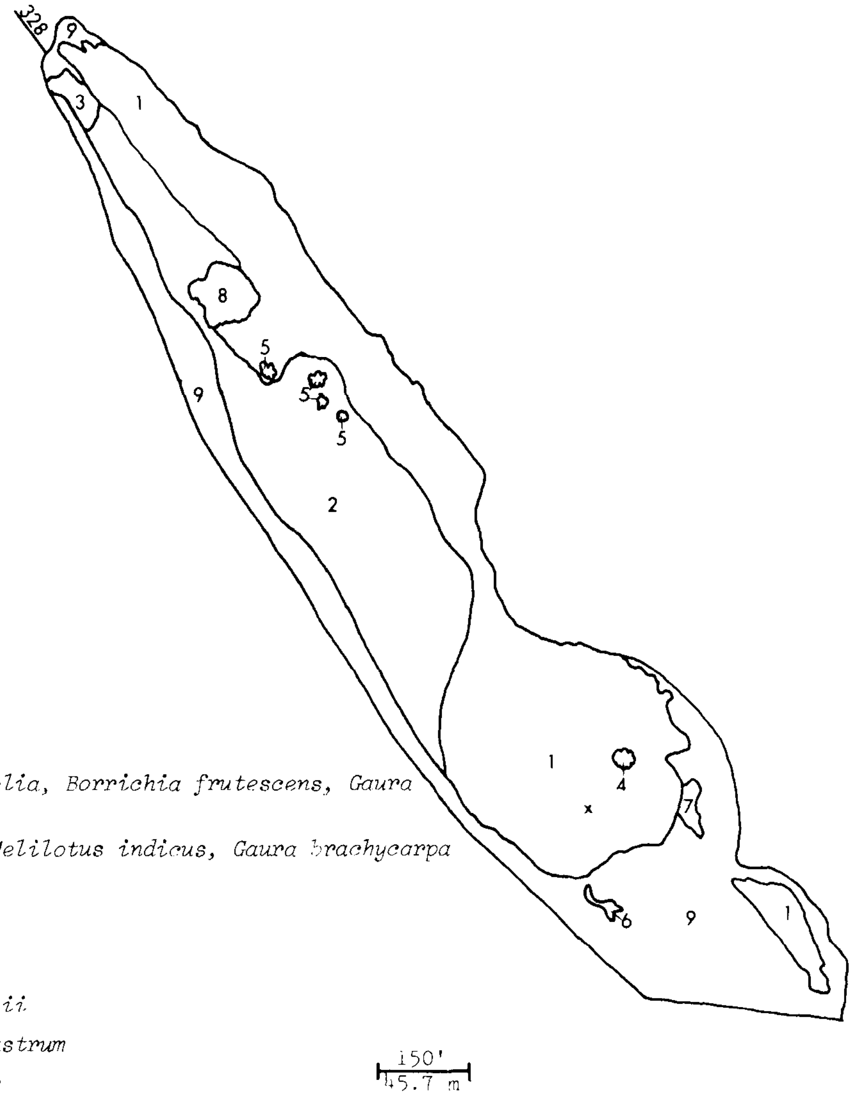
1. *Zanthoxylum Clava-Herculis, Celtis Lindheimeri, Parkinsonia aculeata*
2. *Iva frutescens, Baccharis halimifolia*
3. *Salicornia Bigelovii*
4. *Distichlis spicata, Spartina patens, Iva frutescens*
5. *Iva frutescens, Zanthoxylum Clava-Herculis, Baccharis halimifolia, Gaura* sp.
6. *Iva frutescens, Centaurea americana, Spartina patens*
7. *Salicornia Bigelovii, Machaeranthera phyllocephala*
8. Shell
9. Mud, Sand
10. *Opuntia Lindheimeri*

■. Pond

Figure 39. Vegetation communities on Island HSC 90. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Cattle Egret
   Roseate Spoonbill
   Black-crowned Night Heron
   Great Egret
   Olivaceous Cormorant
   Snowy Egret
   Louisiana Heron
   Great Blue Heron

Figure 40. Location and species composition of nesting bird colonies on Island HSC 90.



1. *Baccharis halimifolia, Borrichia frutescens, Gaura brachycarpa*
2. *Spartina patens, Melilotus indicus, Gaura brachycarpa*
3. *Spartina patens*
4. *Salix nigra*
5. *Tamarix africana*
6. *Salicornia Bigelovii*
7. *Sesuvium Portulacastrum*
8. *Spartina spartinae*
9. Sand, Shell

Figure 41. Vegetation communities on Island HSC 88. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

177. Bulkhead Reef (HSC 76). Bulkhead Reef was a large dredged material island located approximately 610 m south of the southern tip of Atkinson Island. The island has been used as a disposal site since 1947 and has received fresh dredged material approximately every two years since that date. The last date of dredged material deposition was August 1977 and it was made on the eastern edge of the island.

178. The island was divided by a dike down the middle of the central portion. Dredged material to the west was older than that to the east. The sediments in the higher areas were predominantly red clay while black sediments occurred in lower areas. The periphery of the island was composed of sand and oyster shells.

179. The western portion of the island was dominated by *Spartina patens* while on the eastern side there were two areas composed almost entirely of *Baccharis halimifolia* (Figure 42). One of these areas was also occupied by *Iva frutescens*, and *Distichlis spicata* surrounded both communities. On the low area in the eastern half of the island *Spartina spartinae* was common.

180. A mixed wading bird colony was located in the *B. halimifolia* community on the southeast part of the island (Figure 43). Although this was not a large colony (Appendix I), it was fairly successful. A Forster's Tern colony was established on the northeastern section but was destroyed by storm tides.

181. Pelican Island (GBFC 11-13). Pelican Island was originally a small natural island in Galveston Bay. Beginning in 1883, the island was used continuously as a disposal site during dredging of the HSC, the Galveston Port Channel and the GIWW. Consequently, the island was greatly enlarged.

182. In 1954, the route of the GIWW was changed to one that cut through the northern tip of Pelican Island, dividing it into two parts. The southern, and largest, portion is now called Big Pelican Island and the smaller, northern isolate is called Little Pelican. The little island was diked on three sides and has been utilized as a disposal site for maintenance dredging of the GIWW. Big Pelican Island, now partially developed along its southwestern shoreline, was diked and receives

1. *Baccharis halimifolia*
2. *Iva frutescens, Baccharis halimifolia*
3. *Distichlis spicata*
4. *Spartina patens, Distichlis spicata, Iva frutescens*
5. *Spartina patens*
6. *Spartina spartinae, Iva frutescens*
7. Sand, Shell

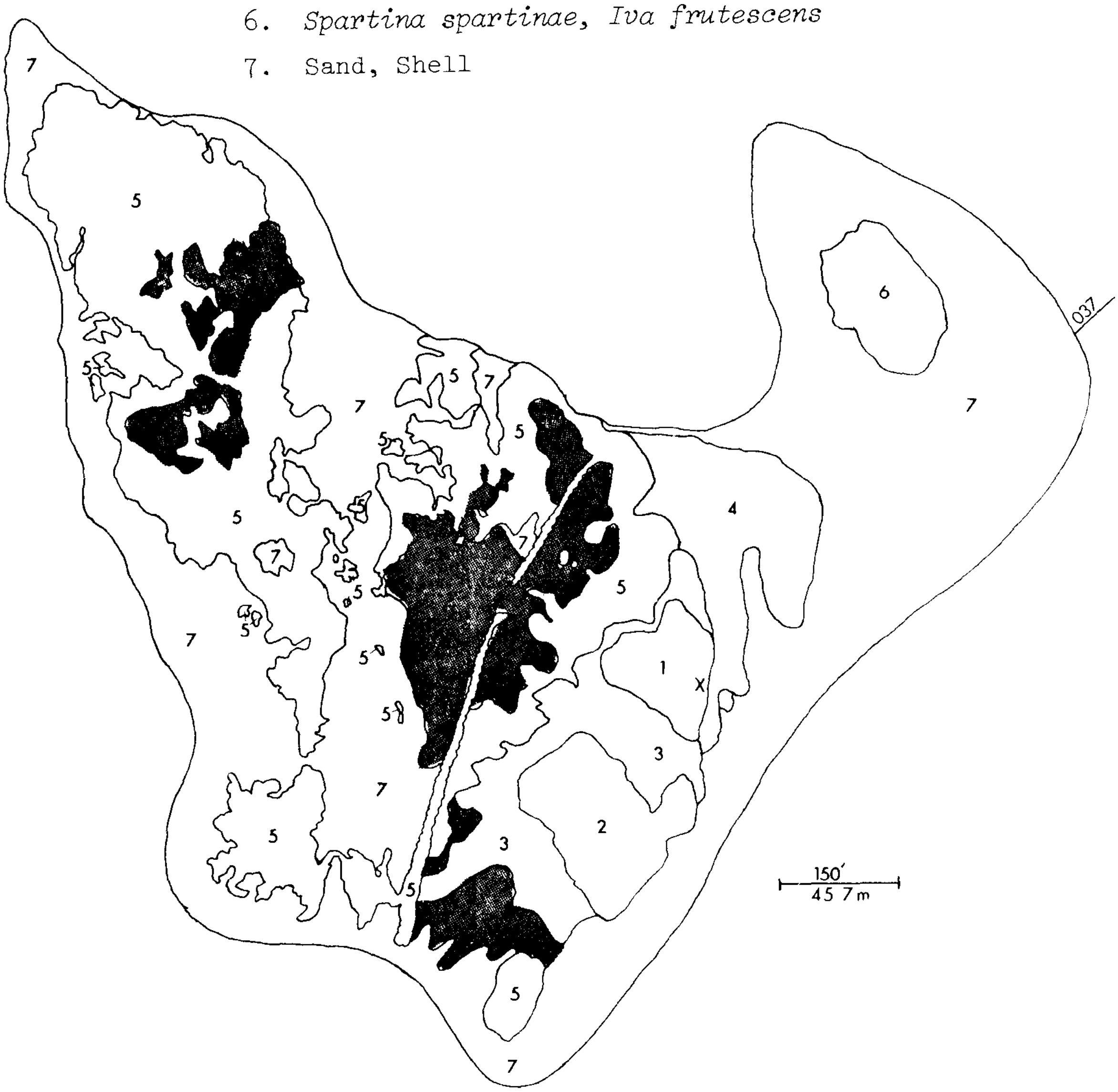
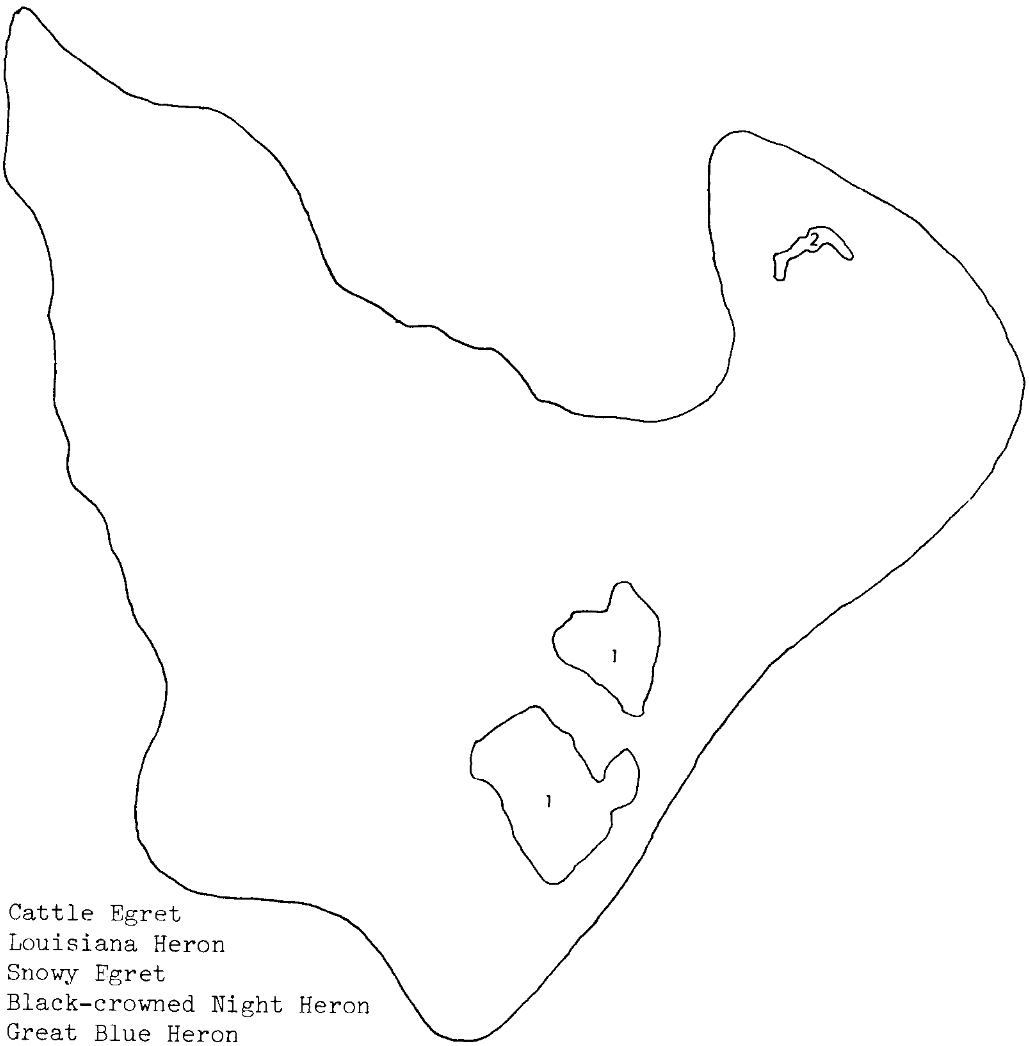


Figure 42. Vegetation communities on Island HSC 76. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. Cattle Egret
   Louisiana Heron
   Snowy Egret
   Black-crowned Night Heron
   Great Blue Heron
   Reddish Egret
   Great Egret

2. Forster's Tern

Figure 43. Location and species composition of nesting bird colonies on Island HSC 76.

dredged material from dredging activities associated with the Galveston Channel, Texas City Channel and the Houston Ship Channel. Both islands harbored large nesting colonies of gulls and wading birds. Little Pelican Island was chosen as a study island because of its size and vegetation complexity.

183. It was the largest island selected for detailed study in the northern specific study area, occupying 48.2 ha. The island was nearly square in shape except for an oyster shell spit that extended to the west from the northwestern corner. The southern edge of the island, which was a mooring area on the GIWW, was diked and the dikes continued inland on both the western and eastern ends (Figure 44).

184. The vegetation community was very complex and probably reflected the repeated deposition of dredged material on the island. The center of the island was dominated by *Borrichia frutescens* with large intermittent areas of open sand. Although *B. frutescens* sometimes occurred in pure stands, there were other areas interspersed with *Aster tenuifolius, Polypogon monspeliensis, Bothriochloa saccharoides* and *Suaeda linearis*. *Baccharis halimifolia* occurred as isolated plants in these associations (Figure 44 and Appendix F).

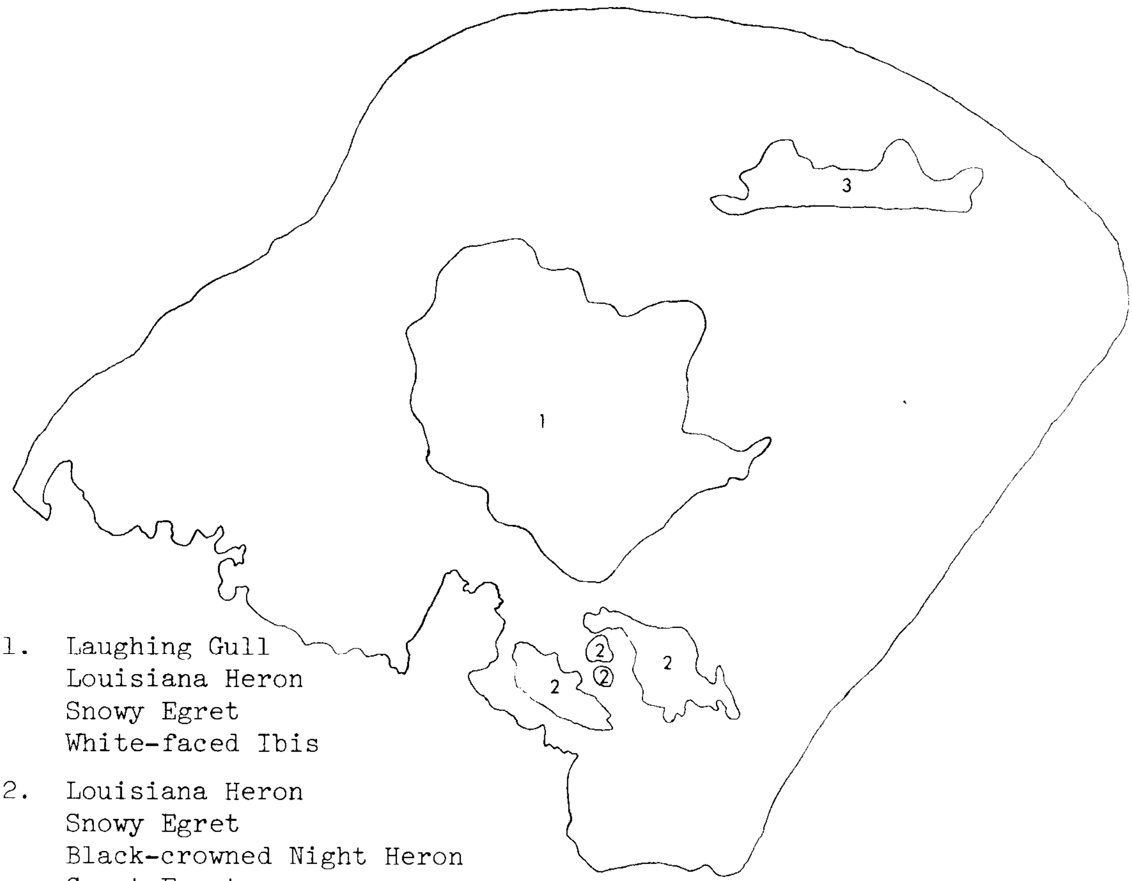
185. On the southeastern corner, *Spartina spartinae* and *Spartina alterniflora* formed an association. *Borrichia frutescens* and *B. halimifolia* also occurred in this area, the latter in association with *Conyza canadensis* and *Gaura brachycarpa* in the east-central portions of the island.

186. Low areas on the periphery of the island were occupied by *Salicornia Bigelovii, Suaeda linearis* and *Spartina alterniflora*. *Batis maritima* occurred on the GIWW side in areas that were partially inundated by tides or boat wakes.

187. A large Laughing Gull colony (Figure 45) was present on the central portions of the island. The gull nests, a ground nest of sticks and shells, were located at the base of *B. frutescens* stands and were concentrated near open, sandy, bare areas. The nests of one portion of the Laughing Gull colony were built atop mats of blown-over *Spartina* spp. White-faced Ibis and Louisiana Heron nests were scattered in the *B.*

1. *Baccharis halimifolia*
2. *Borrichia frutescens, Baccharis halimifolia, Polypogon monspeliensis, Lepidium virginicum, Suaeda linearis*
3. *Spartina patens, Spartina spartinae, Bothriochloa saccharoides, Baccharis halimifolia, Borrichia frutescens*
4. *Gaura brachycarpa, Conyza canadensis, Baccharis halimifolia, Borrichia frutescens*
5. *Salicornia Bigelovii*
6. *Spartina alterniflora, Salicornia Bigelovii, Suaeda linearis*
7. *Borrichia frutescens*
8. *Spartina patens*
9. Sand, Shell
10. *Salix nigra*

Figure 44. Vegetation communities on Island GBFC 11-13. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. Laughing Gull
   Louisiana Heron
   Snowy Egret
   White-faced Ibis
2. Louisiana Heron
   Snowy Egret
   Black-crowned Night Heron
   Great Egret
   Roseate Spoonbill
   Great Blue Heron
   Cattle Egret
3. Black-crowned Night Heron
   Great Blue Heron

Figure 45. Location and species composition of nesting bird colonies on Island GBFC 11-13.

frutescens community.

188. Two mixed wading bird colonies occurred in areas of high densities of *Baccharis halimifolia*. Included were nests of the Great Blue Heron, Great Egret, Snowy Egret, Cattle Egret, Black-crowned Night Heron, and Roseate Spoonbill. Records from the 1976 Fish Eating Bird Survey indicate that Reddish Egrets nested in these colonies in low densities, but they were not present in 1977.

189. Gull-billed Terns and Forster's Terns made nesting attempts in 1977 on the northwestern portion of the island, but were unsuccessful. Heavy rains may have destroyed these early attempts at nest construction.

190. Nesting success, especially in the Laughing Gull colony, was low (Appendix I). Although it was almost impossible to determine fledging success, apparently few Laughing Gulls fledged because few young were seen. A heavy rain killed many newly hatched young and there was a population of black rats, *Rattus rattus* (Linnaeus) on the island, which have been known to kill young birds.

Trinity River Channel islands

191. The Trinity River Channel extends from Anahuac south and southwest along the eastern shoreline of Trinity Bay to Smith Point. After a short land cut at Smith Point, the channel was dredged southwestwardly along the south side of Red Fish Reef in Galveston Bay to a junction with the Houston Ship Channel at a point approximately 18.5 km northwest of Bolivar Roads Pass (Appendix B).

192. Construction of the channel was authorized in 1946 (House of Representatives 1946). Dredging of the channel commenced in July 1949 and was completed in April 1950 (Cobbs, USACE, Galveston District, personal communication). It was dredged 91.4 to 121.9 m from the shoreline from Anahuac to Smith Point and the excavated material was deposited in a continuous protective embankment along the bay side of the channel. However, wave erosion destroyed most of the embankment and all that remained were nine narrow remnant islands.

193. Maintenance dredging was completed only once and that was from October 1972 to January 1973. The channel was maintained only from

the Houston Ship Channel north to the land cut at Smith Point to allow shrimp boats access to the town of Smith Point. Dredged material was deposited to the north side of Smith Point Island #1 and upon TRC 7.

194. Three islands along the Trinity River Channel--Smith Point #1, TRC 2 and TRC 7--were chosen for detailed studies (Appendix B).

195. Trinity River Channel Island #2 (TRC 2). One of the island remnants of the Trinity River Channel construction, TRC 2, was not much more than an elongate spit occupying 0.7 ha. The soil was a heavy red clay.

196. There was a heavy vegetative cover on the island (Figure 46). The tallest plants were salt cedar trees, *Tamarix gallica*, which occurred in a large area on the wide end of the island and in smaller clumps throughout the island's length. *Baccharis halimifolia* stands occurred adjacent to the *Tamarix gallica* on the western end of the island and *Spartina patens* grew in other areas.

197. The boundaries of the mixed wading bird colony on TRC 2 coincided exactly with the area occupied by the *Tamarix gallica* (Figure 47). A total of nine species of wading birds shared the *Tamarix gallica* for nesting. Olivaceous Cormorants generally nested in the tops of the trees, Great Egrets, Great Blue Herons and Roseate Spoonbills found nest sites below the cormorants and the remainder of the species nested in various locations in the *Tamarix gallica*.

198. Nest success on TRC 2 was affected by the activities of Cattle Egrets who began building nests on TRC 2 after the other nesting birds already had eggs or young (Appendix I). To construct their nests the Cattle Egrets stole nest material from occupied nests of other species of wading birds. A high proportion of nest and egg loss in the TRC 2 colony could be traced to nest destruction by Cattle Egrets.

199. Trinity River Channel Island #7 (TRC 7). The size of TRC 7, 0.6 ha, has not changed significantly since 1961. In 1973 the island received a limited amount of dredged material deposition when the channel to the city of Smith Point was maintenance dredged.

200. The vegetative community was similar to that of TRC 2. *Tamarix gallica* trees were the tallest vegetation and were surrounded by

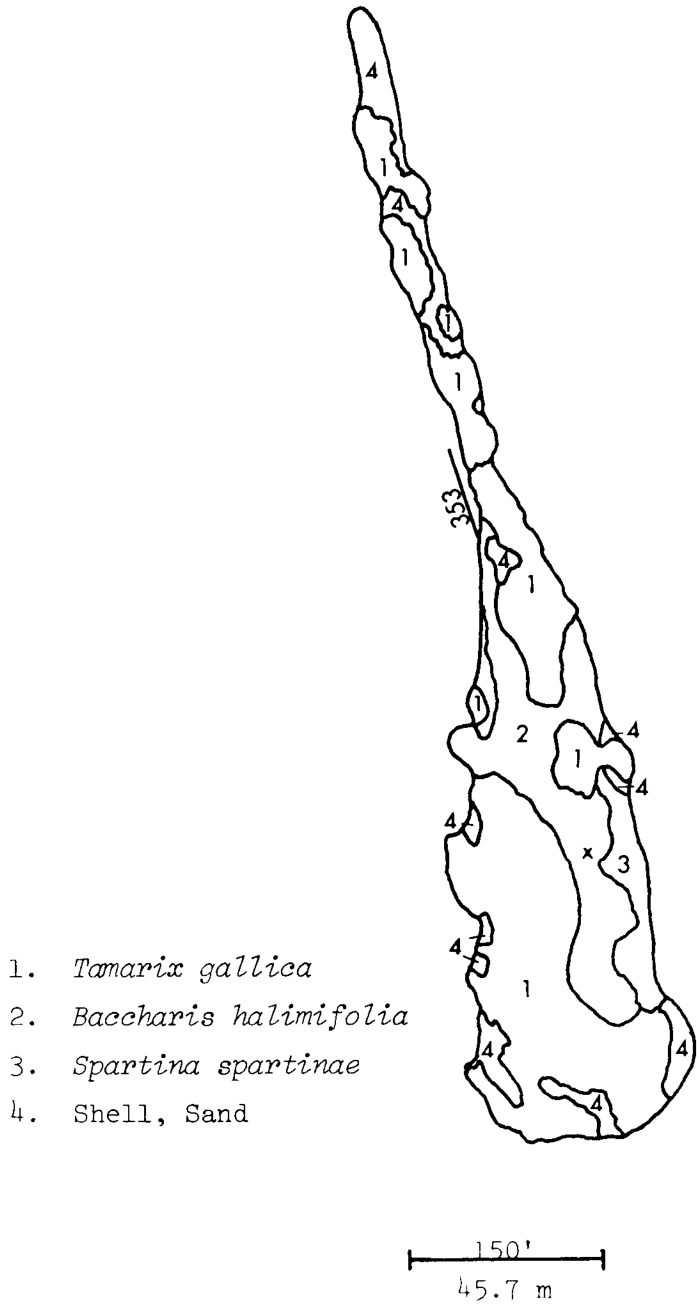
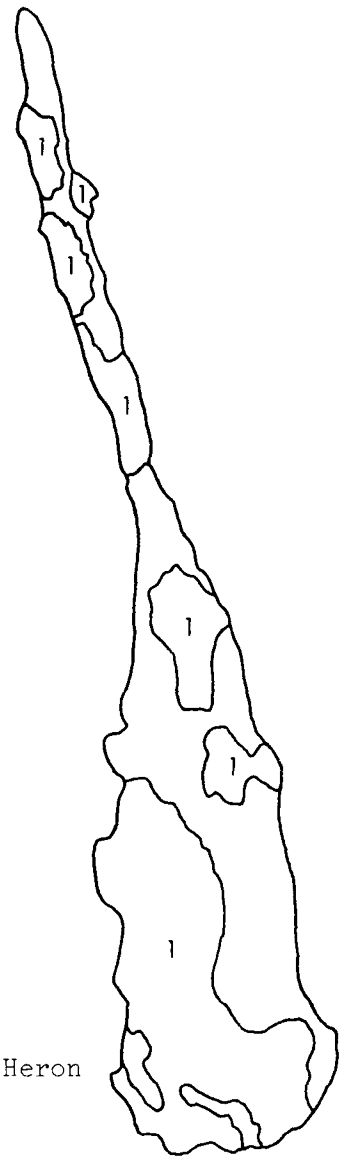


Figure 46. Vegetation communities on Island TRC 2. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).



1. Great Egret
   Cattle Egret
   Roseate Spoonbill
   Olivaceous Cormorant
   Louisiana Heron
   Snowy Egret
   Black-crowned Night Heron
   Great Blue Heron
   Green Heron

Figure 47. Location and species composition of nesting bird colonies on Island TRC 2.

Spartina spartinae and *Iva frutescens* association. *Spartina alterniflora* occurred at the tideline (Figure 48).

201. Only Green Herons nested on this island, building their nests in the *Tamarix gallica* stands (Figure 49). The 24 nests were loose platforms of twigs built between three or more stems approximately 1.2 to 1.8 m above ground (Appendix I).

202. Fire ants were common on TRC 7, but did not appear to harm the nest success of the Green Herons. One Mottled Duck nest containing eight eggs was destroyed by an unknown predator.

203. Smith Point Island (TRC 10). Smith Point Island, labeled "Nigger Island" on early maps (Wood 1944), was originally a natural island in Red Fish Reef. Dredged material was deposited on the island in 1950 during the construction of the Trinity River Channel. Except for an additional deposition of dredged material on the north side of the island in 1973 (Buddy Whitehead, Audubon Warden, Vingt-et-un Island, personal communication), there have been no further disturbances of the vegetative community.

204. The island was surrounded by oyster shell banks that extended from the shoreline to the 1.8-m elevation of the island. *Tamarix gallica* occurred in three large areas on the island (Figure 50). Dense vegetation, mainly *Baccharis halimifolia*, grew in depressions on the north side of the island. The remainder of the island was dominated by low vegetation, the most abundant of which included *Machaeranthera phyllocephala*, *Ambrosia psilostachya*, *Gaura brachycarpa* and *Scuttelaria muriculata*. A parasitic epiphyte, *Cuscuta cuspidata*, was common in these low shrubby areas.

205. A mixed colony of six species of wading birds nested in the *Tamarix gallica* (Figure 51). Great Blue Herons and Roseate Spoonbills nested on the tree tops and higher outer foliage areas. Snowy and Cattle Egrets nested on lower, outer foliage. Black-crowned Night Herons and Louisiana Herons nested beneath the foliage near the center of the tree.

206. According to the Fish-eating Bird Survey, approximately 100 Black Skimmers nested on the island in 1976. Nest scrapes typical of Black Skimmers were found in January 1977 in an oyster shell area with

1. *Tamarix gallica*
2. *Spartina spartinae, Iva frutescens, Lycium carolinianum*
3. *Spartina alterniflora*
4. Shell, Sand

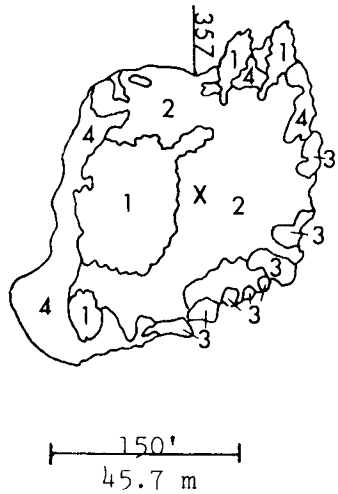
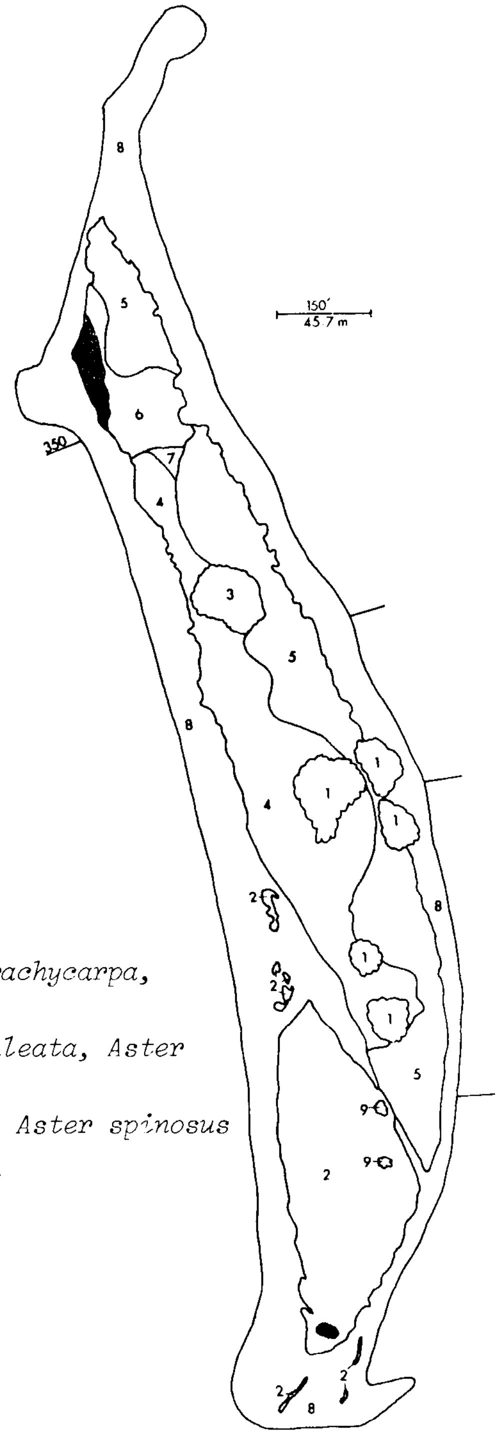


Figure 48. Vegetation communities on Island TRC 7. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Green Heron

Figure 49. Location and species composition of nesting bird colonies on Island TRC 7.



1. *Tamarix gallica*
2. *Machaeranthera phyllocephala, Gaura brachycarpa, Scutellaria muriculata*
3. *Baccharis halimifolia, Parkinsonia aculeata, Aster spinosus*
4. *Iva frutescens, Baccharis halimifolia, Aster spinosus*
5. *Gaura brachycarpa, Opuntia Lindheimeri*
6. *Distichlis spicata, Spartina patens*
7. *Opuntia Lindheimeri*
8. Shell
9. *Sesbania Drummondii*

■. Ponds

Figure 50. Vegetation communities on Island TRC 10. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

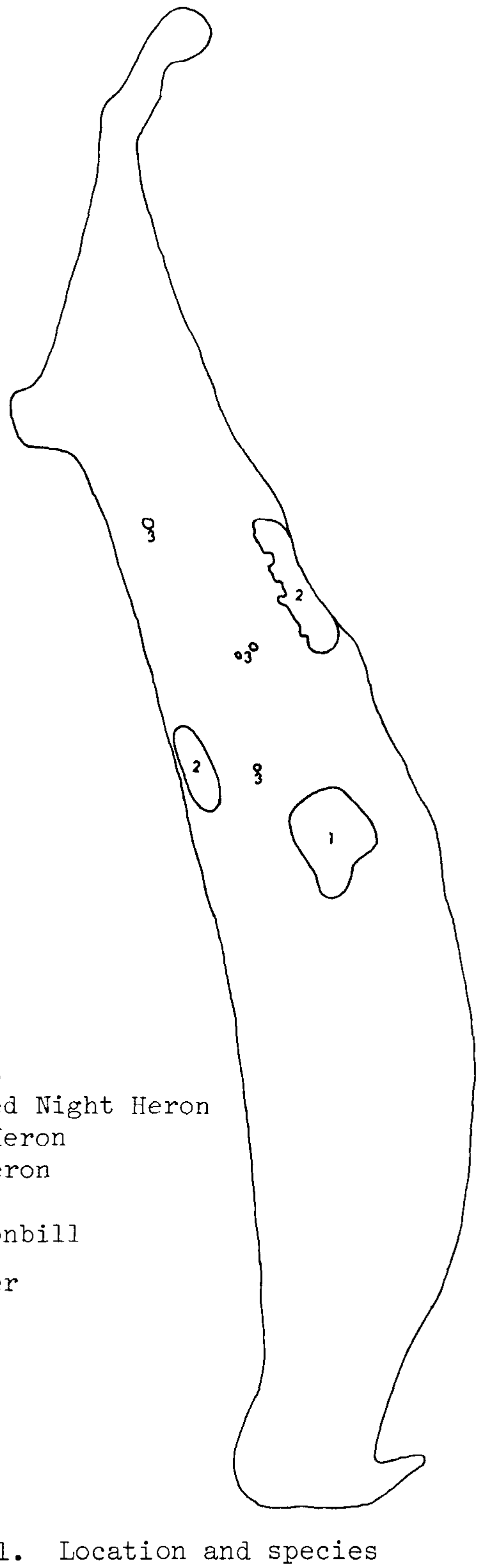


Figure 51. Location and species composition of nesting bird colonies on Island TRC 10.

sparse vegetation near the island center. In June 1977 a colony of approximately 75 pairs of skimmers began excavating scrapes in an oyster shell bank on the western end of the island. The colony was abandoned after storm tides washed the scrapes away. The skimmers moved to a high area approximately 100 m west and constructed 43 nests. The colony was successful. In August a second colony of 20 pairs began to build nest scrapes and on 26 August two nests contained one egg each. This colony was not studied after that date.

East Bay Islands

207. Rollover Bay was a small embayment located on the Gulf at the eastern end of East Bay. There was tidal exchange of water through a narrow artificial pass between Rollover Bay and the Gulf of Mexico (Appendix B).

208. The GIWW was dredged through Rollover Bay during 1938 and 1939 and this portion of the channel has been maintenance dredged on a two-year basis since then. Until July 1968, dredged material was placed on any of eight dredged material islands located on the north side of the channel or on any of twelve small islands on the south side. Since 1968, all disposals were made in large diked areas on land banks at either end of Rollover Bay. Only four islands on the north side of the channel remain. Remnants of the islands once present on the south side of the GIWW persisted as exposed bars during low tides.

209. The two westernmost and the easternmost islands in Rollover Bay were selected for detailed study. These islands, called Rollover Bay #1, #2 and #4, were chosen because of the complexity of their vegetation communities and their differences in size. Characteristically, the southern side, the side nearest the GIWW, had a steep embankment above an oyster-shell shore-line while the north facing side, which received storm waves, was low and eroded. Salt marsh species dominated the northern periphery.

210. Rollover Bay #1 (RB 1). Rollover Bay #1 was the largest and westernmost of the four existent islands in East Bay. This low island was basically rectangular in shape and measured 91.4 by 205.2 m. The

height of the island was 1.8 m at the highest points and less than 0.6 m in the lower areas. Wakes from passing boats occasionally inundated the lower sections. The island occupied approximately 1.5 ha.

211. Soils of the island were composed of fine sand and some silt, with lenses of clay, coarser sand and larger particles. Thin surface veneers of soil were usually composed of fine sand. Oyster shell banks were deposited in windrows on the western edge of the island. Oyster shells were found elsewhere on the island periphery mixed with the sediment of the entire island.

212. Variations in slope and elevation were the major factors that controlled plant distribution on the island. The highest point was in the southwestern corner of the island in an area representing the apex of a deposition cone. Outflow from the dredge pipe had created a depression there that filled with water after rains. The elevated area was composed of a shrub community dominated by *Baccharis halimifolia* and *Iva frutescens* (Figure 52).

213. The *Iva-Baccharis* community was sharply delineated on its south and west sides by a vertical escarpment that dropped to bare mud or mud-oyster flats. The shrub community intergraded down the eastern slope of the cone with a large community composed of a *Distichlis spicata* and *Spartina alterniflora* association. Along the ecotone where these communities met, *Borrichia frutescens* intermixed. On the northern side of the island *Spartina alterniflora* formed a pure stand where tidal inundation occurred.

214. The eastern end of the island was very low in elevation. Although it was above mean high tide and remained dry under normal conditions, the area was subject to periodic inundation by storm tides or waves during periods of high winds. The vegetation was a mixed community of facultative halophytes including *S. alterniflora, D. spicata, Salicornia Bigelovii* and *Machaeranthera phyllocephala*. Bare, sandy areas were common in this area and one such bare area separated this community from the *Distichlis-Spartina* association.

215. A total population of approximately 350 pairs of Black Skimmers constructed nests in four areas of open sand (Figure 53).

1. *Iva frutescens, Baccharis halimifolia*

2. *Spartina alterniflora*

3. *Spartina alterniflora, Distichlis spicata, Borrichia frutescens*

4. *Machaeranthera phyllocephala, Distichlis spicata, Salicornia Bigelovii, Spartina spartinae*

5. *Borrichia frutescens*

6. Sand, Shell

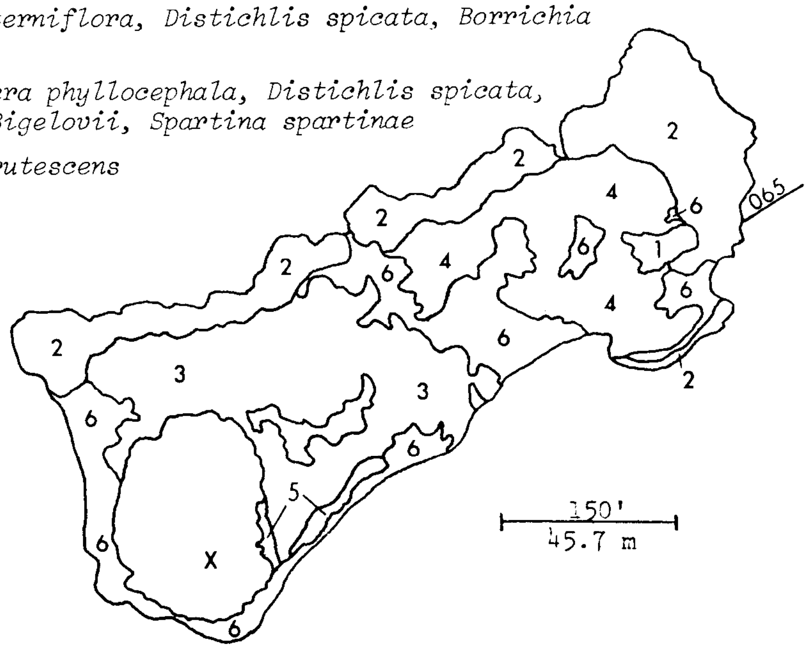


Figure 52. Vegetation communities on Island RB 1. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Great Egret
   Snowy Egret
   Louisiana Heron
   Black-crowned Night Heron

2. Forster's Tern

3. Black Skimmer

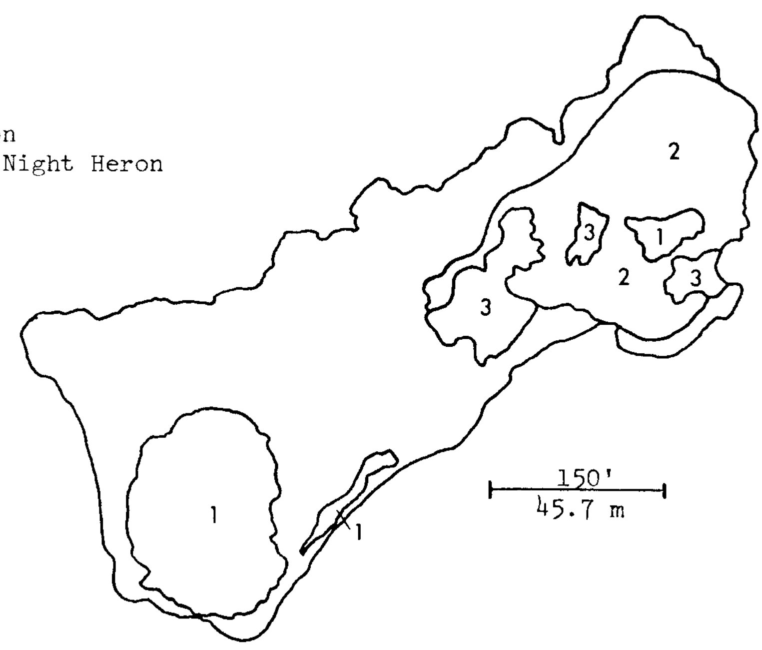


Figure 53. Location and species composition of nesting bird colonies on Island RB 1.

216. Forster's Terns constructed nests in two distinct habitat types on the islands. Most nests were built on *Spartina alterniflora* clumps that had been blown over and matted by the wind. The nests were formed of cordgrass leaves and *Salicornia Bigelovii* stems, and were woven into the *S. alterniflora* mat. Other nests were constructed atop dry-docked rafts of drift material. This tern colony was very successful (Appendix I).

217. A mixed heronry occurred in the three areas dominated by the *Baccharis-Iva* association. The nesting habits of the four species of wading birds in these colonies were quite variable. Great Egrets, for example, nested on the ground atop 30 cm high *Iva augustifolia* and up to 1.8 m above the ground in mature *B. halimifolia* and *Iva frutescens*.

218. Rollover Bay #2 (RB 2). The smallest of the four dredged material islands in East Bay was Rollover Bay #2 which was 0.6 ha in size. The island was roughly rectangular-shaped measuring 43.0 by 80.2 m. The slope on the island was gentle, increasing from sea level to 1.1 m at the top of a dredged material cone. There was a depression in the cone that acted as a catch basin for rainwater.

219. Soils and vegetation of the island were similar to Rollover Bay #1. An *Iva frutescens* community dominated the higher elevations. The *Iva* community was punctuated with isolated clumps of *Opuntia Lindheimeri*. Stands of *Borrichia frutescens* were found on the periphery of the *Iva frutescens* community and intergraded with that community in those areas (Figure 54).

220. In the lower areas on the western side, a *Distichlis spicata* association dominated. It was generally located just above mean high tide and intergraded with *I. frutescens* upslope. A pure stand of *Spartina alterniflora* occurred on the northern side of the island and extended from mean high tide to areas of shallow water.

221. Birds used Rollover Bay #2 throughout the nesting season as a roosting, loafing and display area. When birds were disturbed by human activity on Rollover Bay #1, the birds invariably flew to this island. Nesting activity did not occur on the island until late in the season when five species of wading birds nested in the *Iva frutescens*

1. *Iva frutescens*
2. *Spartina alterniflora*
3. *Distichlis spicata*
4. *Borrichia frutescens*
5. Sand, Shell

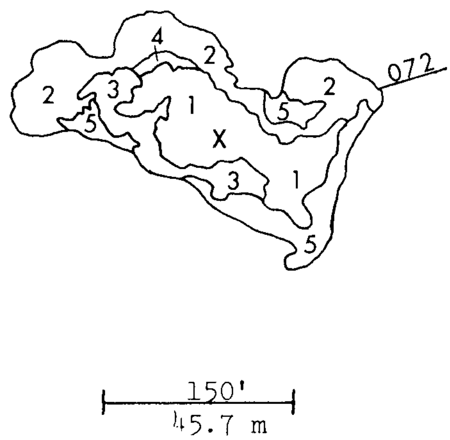


Figure 54. Vegetation communities on Island RB 2. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Cattle Egret
   Snowy Egret
   Louisiana Heron
   Great Egret
   Black-crowned Night Heron

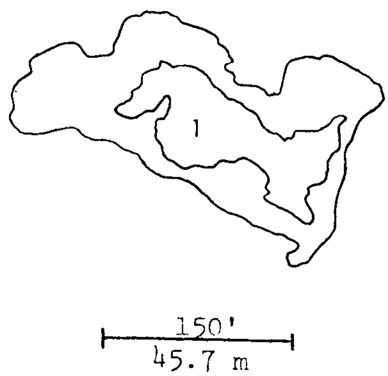


Figure 55. Location and species composition of nesting bird colonies on Island RB 2.

community (Figure 55). Colony size and hatching success are noted in Appendix I.

222. Rollover Bay #4 (RB 4). The easternmost island in East Bay, Rollover Bay #4, occupied 0.7 ha. The island lacked a slope gradient but in other respects the island was similar to the other Rollover Bay islands.

223. An *Iva frutescens* community was replaced by a *Borrichia frutescens-Lycium carolinianum* association in a slightly lower area of sand. *Spartina alterniflora* occurred in a mud-flat area on the northern side of the island (Figure 56).

224. A mixed wading bird colony nested in the *Iva frutescens* community (Figure 57). Colony size and success are shown in Appendix I.

West Bay Islands

225. A 1.5-m-deep channel between Galveston and Corpus Christi was completed in 1913 (Richardson 1950). This channel was deepened to 2.7 m and widened to 30.5 m in 1933. Although the construction of this channel did not result in the creation of dredged material islands, the northern tip of one of two large natural islands in West Bay was severed, creating a small remnant island. In 1944 the GIWW was enlarged to its present dimensions. As a result, ten islands were formed to the east and eight partially joined islands were created to the north of North Deer Island, a natural island. Dredged material was also deposited in four cones on North Deer Island.

226. Subsequent dredging history of these islands was scant. Save for the interpretation of a few old aerial photographs of the area, it was impossible to determine when and where dredged material was deposited during maintenance dredging operations. The GIWW section through West Bay was dredged approximately every two years. Distance to the nearest land bank and the absence of any evidence of subaqueous deposition in the area indicated that maintenance dredging deposits were made on these islands. However, a written record was lacking.

227. Four of these islands were chosen as study islands. In addition, a series of recently deposited, small islands nearer to the

1. *Iva frutescens*
2. *Borrichia frutescens, Lycium carolinianum*
3. *Spartina alterniflora*
4. Shell

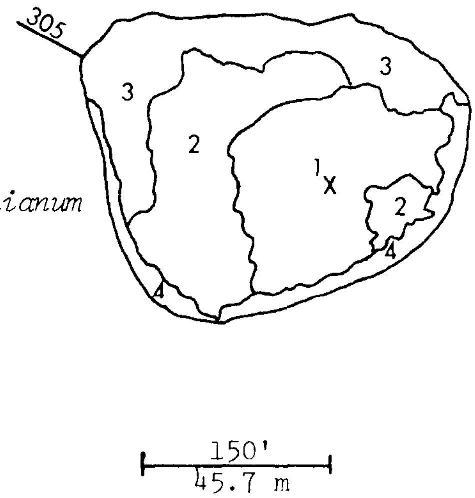


Figure 56. Vegetation communities on Island RB 4. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Snowy Egret
   Louisiana Heron
   Cattle Egret
   Black-crowned Night Heron
   Great Egret

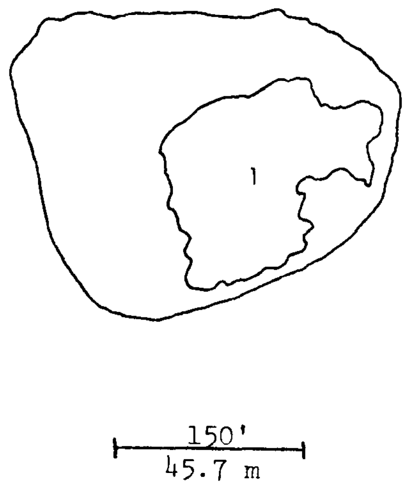


Figure 57. Location and species composition of nesting bird colonies on Island RB 4.

causeway were selected for detailed study.

228. Down North Deer Island (WB 43). Down North Deer Island was situated approximately 400 m east of North Deer Island, a large, natural island known for its large wading bird rookeries. Aerial photographs taken in 1961 indicated that there were fresh deposits along the northern, or GIWW facing, side. In 1961 the island was approximately twice as large as its 1977 size of 0.7 ha.

229. There was a high bank of reddish clay on the channel side of the island which sloped to the south and west down to a salt-marsh community. The west end of the island tapered to a long exposed oyster shell bank.

230. The higher portions of the island were occupied by a dense *Baccharis halimifolia* community (Figure 58). Lower areas of the island were covered with a dense association of *Borrichia frutescens* and *Lycium carolinianum*. In one area *Batis maritima* replaced *B. frutescens* in the association. *Spartina alterniflora* and *Opuntia Lindheimeri* occurred in isolated clumps on the island.

231. A colony of approximately 65 pairs of Louisiana Herons was established early on the island in the *Baccharis* community (Figure 59). For unknown reasons this colony was partially abandoned and was not very successful.

232. High Bank Island (WB 41). High Bank Island was the larger of two similar, severely eroded dredged material islands located east of North Deer Island. The island was approximately four times its present dimensions of 7.9 by 100.0 m in 1961. There were indications that a fresh dredged material deposit was made on it just prior to the 1961 photograph.

233. The island was composed of a reddish clay which had eroded away leaving steep banks on all sides. Each end was higher than the middle of the narrow island. The low area beneath the banks was composed of water-saturated clay and a long shell bank tapered away from the island on the west end.

234. A short-grass association dominated the island. *Hordeum vulgare* and *Cynodon Dactylon* were the major grasses. Other plants such as *Borrichia frutescens*, *Iva frutescens* and *Acacia Smallii* occurred

1. *Baccharis halimifolia*
2. *Borrichia frutescens*, *Lycium carolinianum*
3. *Lycium carolinianum*
4. Shell

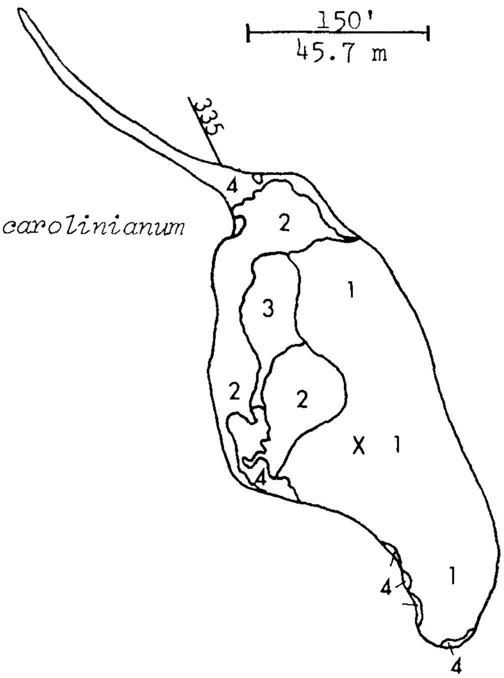


Figure 58. Vegetation communities on Island WB 43. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Louisiana Heron
2. Little Blue Heron

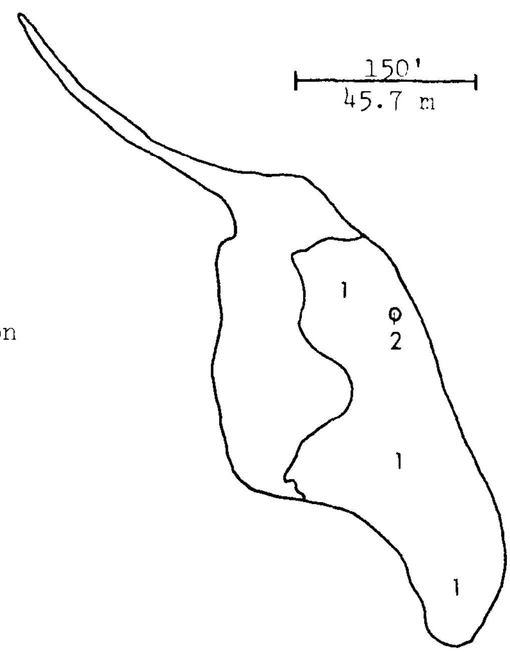


Figure 59. Location and species composition of nesting bird colonies on Island WB 43.

individually or in clumps on the island (Figure 60).

235. In January 1977, there were remains of nests in the taller vegetation. For this reason, the island was selected for detailed study, but no birds nested on High Bank Island in 1977.

236. Causeway Island #1 (WB 52). Causeway Island #1 was situated on the northern side of the GIWW across from North Deer Island. The island was large, 1.3 ha and there was a high peak (elevation 3.4 m) near the center of the island with a uniform slope on all sides. Humus-rich soil was underlain by reddish-tan clay on the upper portions of the island and an oyster shell embankment was present on the west end.

237. The plant communities on WB 52 corresponded to elevation. Near the apex, two dense stands of *Lycium carolinianum* occurred. Most of the island area was dominated by an association of *Iva frutescens* and *Baccharis halimifolia*. *Opuntia Lindheimeri* also occurred in clumps within the *Iva-Baccharis* association. *Spartina alterniflora* was common on low, muddy areas on the periphery of the island (Figure 61).

238. A mixed colony of wading birds nested in the *Iva-Baccharis* association (Figure 62) but it was not successful (Appendix I). Two carcasses of Opossums, *Didelphis virginiana* Kerr, and a Western Diamond-backed Rattlesnake, *Crotalus atrox* Baird and Girard, were observed on the island. These predators could have had an adverse effect on colony success.

239. Causeway Island #2 (WB 52A). Causeway Island #2, approximately 50 m west of Causeway Island #1, was the second in a series of eight dredged material islands on the north side of the GIWW. In 1961 Causeway Island #2 was almost barren after having been covered with fresh dredged material. In 1977 the island was somewhat high (elevation 3.6 m) and larger (1.9 ha) than Causeway Island #1, but the vegetation communities were similar.

240. The higher areas were occupied by *Iva frutescens* which was interspersed with clumps of *Opuntia Lindheimeri* and patches of *Hordeum vulgare* (Figure 63). A low area on the eastern side was dominated by *Spartina spartinae*. Areas near the tide lines were occupied by *Spartina alterniflora, Lycium carolinianum* and *Salicornia Bigelovii*. The under-

1. *Hordeum vulgare, Cynodon Dactylon*
2. *Borrichia frutescens*
3. *Acacia Smallii*
4. *Iva frutescens*
5. Shell

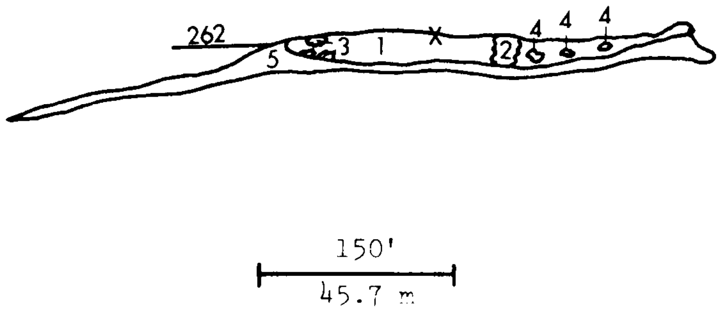
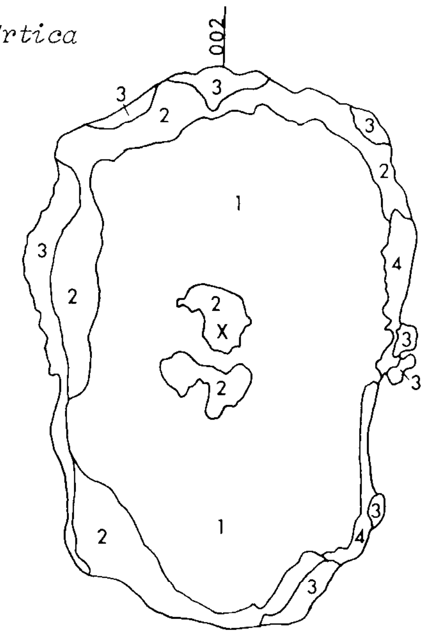


Figure 60. Vegetation communities on Island WB 41. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

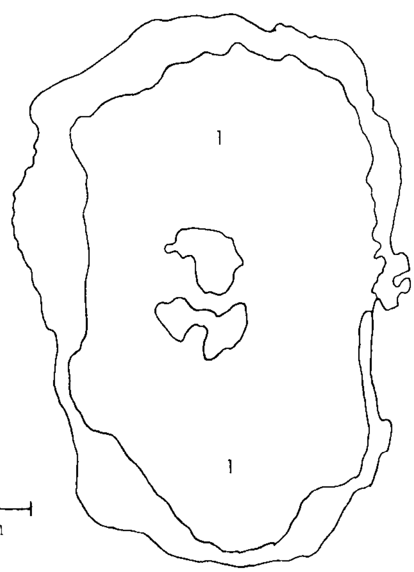
1. *Iva frutescens*, *Baccharis halimifolia*, *Urtica chamaedryoides*
2. *Lycium carolinianum*
3. *Spartina alterniflora*
4. Shell, Sand



150'
45.7 m

Figure 61. Vegetation communities on Island WB 52. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Louisiana Heron
   Snowy Egret
   Reddish Egret
   Great Egret
   Black-crowned Night Heron
   Little Blue Heron



150'
45.7 m

Figure 62. Location and species composition of nesting bird colonies on Island WB 52.

1. *Iva frutescens*, *Hordeum vulgare*, *Opuntia Lindheimeri*
2. *Spartina spartinae*, *Sporobolus virginicus*, *Opuntia Lindheimeri*
3. *Spartina alterniflora*, *Lycium carolinianum*, *Salicornia Bigelovii*
4. *Opuntia Lindheimeri*
5. Sand
6. Shell

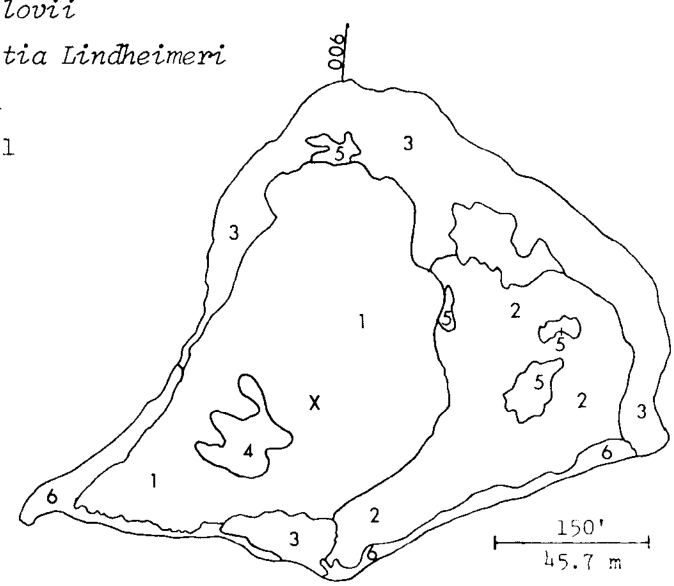


Figure 63. Vegetation communities on Island WB 52A. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

1. Louisiana Heron
   Snowy Egret
   Reddish Egret
   Great Egret
   Black-crowned Night Heron
   Little Blue Heron

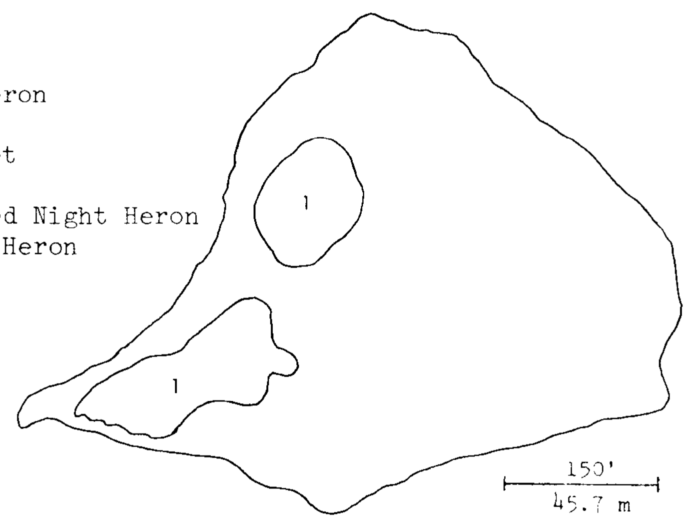


Figure 64. Location and species composition of nesting bird colonies on Island WB 52A.

story on this island was composed largely of a nettle, *Urtica chamaedryoides*.

241. A small, mixed colony of Louisiana Herons, Snowy Egrets, Reddish Egrets, Great Egrets, Black-crowned Night Herons, and Little Blue Herons, nested in the *Iva frutescens* community (Figure 64). So few nests were established (Appendix I) that no nests were followed through the season. The Louisiana Herons abandoned the colony shortly after nest construction.

242. Jigsaw Islands (WB 37). The substrate of the Jigsaw Islands was deposited in a subaqueous bank in late 1972. Due to the influence of currents, wave action and tides, the islands began to emerge in 1973. Because of the peculiar nature of these islands a marine biologist, Robert Bass, of the Galveston District, USACE, visited the islands periodically and provided an account of their development. Excerpts from his notes are summarized in the following paragraphs.

243. In November 1973, approximately 50 small islands were emergent. By 6 March 1974 the first vegetation, consisting of *Limonium Nashii*, *Salicornia virginica* and an unknown species, was noted. On 9 April 1974 *Lycium carolinianum* was found growing on the islands.

244. On 7 May 1974 Royal Terns and Black Skimmers were found nesting in separate open areas on the older, larger islands. At this time *Spartina* sp. was found. Bass noted that the vegetation was distributed as a function of the elevation, that is, most of the vegetation was distributed around the base of the island at a level corresponding roughly to the mean high tide level. Laughing Gulls were using the vegetation as nest sites on 3 June 1974.

245. The vegetation was dense and growing above the mean high tide level in February 1975. By May 1975, Forster's Terns, Royal Terns, Caspian Terns and Laughing Gulls were nesting on many of the islands. Several new plant species were noted but positive identification was not made. The islands were not visited by Bass after 1975.

246. In 1977, there were 27 emergent islands in the Jigsaw Island complex (Figure 65). None of the islands exceeded 0.2 ha in size and eight were less than 400 square meters. Three higher areas of red

1. *Chenopodium albescens, Suaeda linearis, Salicornia virginica*
2. *Borrichia frutescens, Opuntia Lindheimeri*
3. *Chenopodium albescens, Batis maritima, Suaeda linearis*
4. *Salicornia virginica*
5. *Lycium carolinianum, Chenopodium albescens*
6. *Spartina alterniflora, Chenopodium albescens*
7. *Salicornia virginica, Suaeda linearis*
8. *Spartina alterniflora*
9. Sand, Shell

Figure 65. Vegetation communities on Island WB 37. Unnumbered areas are devoid of vegetation. The magnetic bearing indicates one of the plant transects taken from the apex (X).

clay, 0.9 m above sea level, were found on the larger islands. Oyster shell and sand were predominant on the lower portions of the islands.

247. There was little apparent pattern to the vegetation on these islands. Mixed communities of *Chenopodium albescens, Suaeda linearis* and *Salicornia virginica* grew on the high areas of most islands. On one island a community of *Borrichia frutescens* and *Opuntia Lindheimeri* occupied the highest area. Other small plant associations are noted in Figure 65.

248. Royal Terns and Sandwich Terns nested in pure or mixed colonies in areas that were devoid of vegetation and where the substrate was composed of shells (Figure 66). The young of these species formed mixed creches which sometimes intermingled with the creches of colonies on adjacent islands. These species were successful in rearing many young (Appendix I). A small number of Caspian Terns nested with Royal Terns on one island.

249. The nests of a small mixed colony of Black Skimmers and Forster's Terns were wiped out by water from an extremely high tide early in the season. The colony was situated where wave action due to wind-fetch was at its maximum.

250. Laughing Gulls nested in both the *B. frutescens* and *C. albescens* communities. The nests were placed at the base of the dense vegetation. Louisiana Herons built nesting platforms in the center of these communities, usually only one to an island. These widespread nests were not monitored.

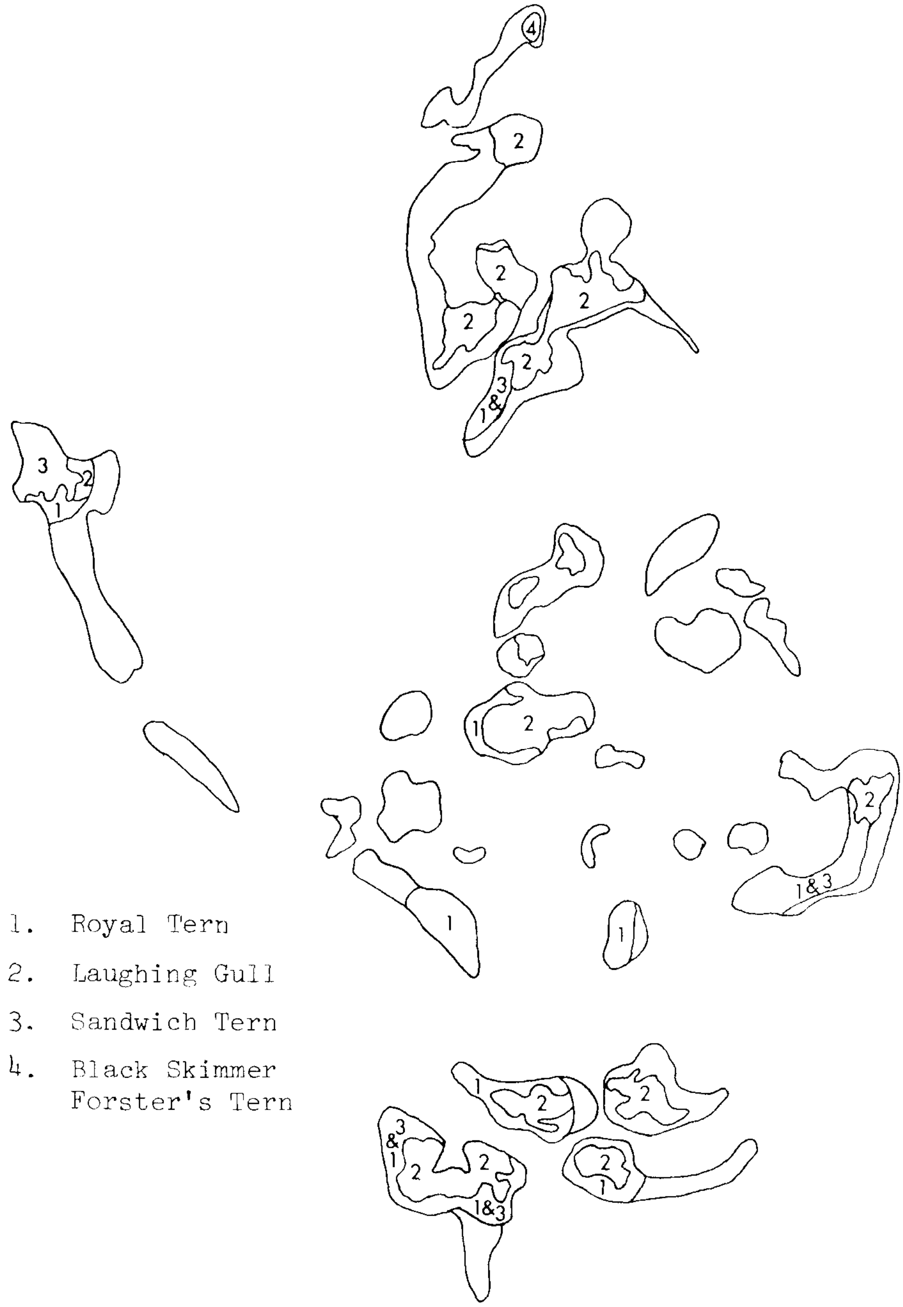


Figure 66. Location and species composition of nesting bird colonies on Island WB 37.

PART IV: DISCUSSION

Vegetative Succession

251. The inability to document the exact age of dredged material deposits in both study areas had made it difficult to determine any definite sequence of plant establishment. None of the islands that were selected were younger than 25 years; and if additional dredged material was deposited, it was in small amounts, most of which ran back into the water. The exceptions were four islands in the southern area and one in the northern area on which large amounts of material were deposited. Three of the islands in the southern area were diked.

Southern Study Area

252. In the southern area the climax vegetation on the higher parts of all the domed islands was that which was characteristic of the coastal prairies, a series of dense to sparse stands of grasses such as *Sporobolus* spp., *Bothriochloa saccharoides, Chloris petraea, Eragrostis* spp. and *Cenchrus incertus* interspersed with *Heterotheca subaxillaris, Hedyotis nigricans, Baptisia leucophaea, Dalea emarginata, Gaillardia pulchella* and *Indigofera miniata*. On the older islands this crown was either sparsely or densely vegetated with the distribution of these plants dependent upon elevation and age. On those islands over 2.4 m in elevation these plants were infrequent. On some islands the crown and slopes of the domes had been invaded by larger species such as *Prosopis glandulosa, Baccharis neglecta, Leucaena leucocephala, Opuntia Lindheimeri* and *Sophora tomentosa* which dominated the grasses and forbs. These invader species were heavily used as nesting sites by birds on all islands.

253. At slightly lower elevations, encircling the crown, typical species associations included the following: *Andropogon glomeratus, Paspalum monostachyum, Aristida intermedia, Sporobolus virginicus, Iva angustifolia, Palafoxia texana, Ambrosia psilostachya* and *Samolus ebracteatus*. *Tamarix ramosissima* was found occasionally interspersed among the other plants in this area but was more commonly found on

the lower slopes among thin to thick stands of *Sporobolus virginicus, Paspalum vaginatum, Monanthochlöe littoralis, Fimbristylis castanea, Machaeranthera phyllocephala, Lycium carolinianum* and *Borrichia frutescens.* These plants occurred in either mixed or nearly monospecific stands and were thickest at the base of the dome. This community usually graded into a community of halophytes that grew on the sand and mud flats and on the berm area near the water. Included were *Salicornia Bigelovii, Salicornia linearis, Batis maritima, Atriplex arenaria, Suaeda linearis* and *Sesuvium Portulacastrum.*

254. The frequency of the plants in the various communities varied from island to island but seemed to be more dense on those with established nesting colonies. This could have been a result of the introduction of nutrients into the soil from the bird guano. Increased plant growth on barren deposits the year following nesting by terns was noted by Mendoza (1974) and Ortiz (1974) on Island LM 57A and by Soots and Parnell (1975a, b) on North Carolina islands.

255. Succession or even initial vegetative growth on these domed islands in the southern area has been very slow. From the examination of various aerial photographs very little growth could be discerned after five years. The only growth that was visible was a ring of scattered vegetation near the shore. These plants were probably the halophytes that had become established in the ridge of sand and decaying detritus from the sea grasses washed onto the shore by wind and wave action or by the tides. The area at the base of the dome was the next to develop vegetation and did so rather rapidly, usually after 5 years and by 10 to 15 years appeared dense. The growth of vegetation on the domes was even slower than that on the slopes. In the photographs, plants appeared to develop more rapidly in erosion channels and in the channels cut by the dredged material runoff when the island was formed or when additional dredged material was deposited. The last part of the island to develop vegetation was the crown. Scattered plants appeared as early as 15 years after formation but as previously stated, some of the crowns of these islands were still sparsely vegetated after almost 30 years.

256. This slow development must have involved leaching of the

minerals and salt from the soils, a slow process in a hypersaline environment. Other factors to consider would be the development of a freshwater lens and its availability to plants, the biologically significant distance over very saline waters for seeds of plants that could colonize the islands, and the development of organic detritus and nitrogen in the soil. The plants that could colonize are those that have wind-carried seeds or possibly those whose seeds are brought to the islands by birds.

257. As an example of a recent vegetation colonization (8 years), dredged material was deposited in two mounds on the eastern edges of LM 57A, probably in 1969. In 1973 these domes were bare (Mendoza 1974 and Ortiz 1974) but in 1974, after supporting a colony of nesting terns, the crowns were partially covered (40 percent) by *Eragrostis oxylepis*. In 1977 the larger dome was more densely covered (70 percent) with *Sporobolus asper, Machaeranthera phyllocephala* and *Cenchrus incertus*. Surrounding the summit was a dense community of *Andropogon glomeratus, Borrichia frutescens, Fimbristylis castanea, Ambrosia psilostachya* and *Sporobolus virginicus*. The zone graded into one containing the typical halophytes. It must be remembered that these mounds were deposited on the shore of a 25-year-old island and colonizing plants had direct access to invade this barren area.

258. The same types of deposits were made on island LM 57 and on LM 57A except three mounds were formed. Again, the crowns were barren in 1974 (Ortiz 1974, Mendoza 1974). During our study, the domes were sparsely covered with *Machaeranthera phyllocephala, Sporobolus asper, Erigeron myrionactis, Oenothera Drummondii* and *Lepidium virginicum*. These were surrounded at the lower levels by the same types of communities as on LM 57A.

259. Three of the specific study islands, LM 39A, LM 43A and LM 47, have been diked and dredged material deposited within the dikes during the last ten years. The eastern half of LM 39A was diked in 1973, the central third of LM 43A between 1968 and 1973 and most of LM 47 in late 1974. Colonization appeared to be more rapid on the dike, both the crest and slopes, and to either side at the base.

260. The mounds on the interior were usually of fine sand and

little vegetation was present. If vegetation was present the pioneer plants were *Oenothera Drummondii* and *Heterotheca subaxillaris*. Areas where the dikes were broken were quickly invaded by the plants on the older adjacent or contiguous parts of the island. These plants included *Sporobolus virginicus*, *Sporobolus asper* and *Dalea emarginata*.

Northern Study Area

261. It was difficult to characterize the sequence of plant succession that occurred on the northern study area islands. For the past ten years there were few dredged material deposits on islands in that area. Most dredged material disposal sites were land banks that had been diked and set aside as permanent disposal bunkers. Consequently, there were few dredged islands of young age that can be used to determine the distribution and sequence of pioneer plants.

262. Furthermore, plant succession patterns, especially the later successional stages, appeared to vary greatly between the West Bay, lower Galveston Bay and East Bay islands and the islands along the Houston Ship Channel and in Trinity Bay. The differences in vegetation patterns between these areas were probably due to differences in bay salinity and the salinity of the sediments. The more northern bays were less saline due to river inflows and the substrate of the islands was primarily sand. The reddish clays of the bays nearer the Gulf took longer to leach out their salt burden than do the sandy soils of the HSC and Trinity Bay islands.

263. The successional sequence in lower Galveston Bay, East Bay and West Bay was not unlike that described for the southern specific area of Texas. Most aspects were similar to the North Carolina dredged material islands described by Soots and Parnell (1975b).

264. The pioneer stage in the development of vegetation on newly created islands in the northern area appeared to follow a pattern. Barren freshly deposited dredged material islands received drift material that collected in two concentric rings around the periphery. The rings of drift corresponded to water levels at high tides and during storms. The drift material contained seeds and viable plant fragments that began to

grow in the protected environment provided by the drift material. The pioneer plants were primarily halophytes and include *Salicornia virginica, Salicornia Bigelovii, Limonium Nashii, Suaeda linearis, Sesuvium Portulacastrum, Batis maritima* and *Lycium carolinianum.* In some areas *Spartina patens* also invaded low areas at an early island age. Judging from the sequence noted on the Jigsaw Islands, invasion of the high tide area by halophytes could occur rapidly. Within 6 months there were plants present on the larger islands in the Jigsaw series.

265. Beyond the pioneer stage, the pattern of vegetative succession could only be compared on an altitudinal gradient corresponding to island height. Above the high tide level the plant composition was primarily facultative halophytes. These species included *Borrichia frutescens, Spartina spartinae, Distichlis spicata, Lycium carolinianum* and *Machaeranthera phyllocephala.* In most cases the height of this vegetation did not exceed 0.9 m.

266. The higher areas of these islands were occupied by dense shrub communities that sometimes reached 1.8 m. The dense shrubs, common nest sites for mixed heronries, were mainly *Iva frutescens* and *Baccharis halimifolia.* Other species such as *Opuntia Lindheimeri, Borrichia frutescens* and *Lycium carolinianum* may occur as dense clumps in the midst of an *Iva-Baccharis* association. Commonly, there was a dense herbaceous understory in this community. A nettle, *Urtica chamaedryoides,* was the most common understory species.

267. No apparent pattern of vegetation could be ascertained for the Trinity Bay and Houston Ship Channel islands. In Trinity Bay the dominant species on mature islands was *Tamarix* spp. This was found both in low and high areas on older islands. It was frequently surrounded by *Baccharis halimifolia, Iva frutescens* and *Borrichia frutescens.*

268. In the Houston Ship Channel, the vegetation of the dredged material islands was not unlike that found in the lowlands of the Trinity or San Bernard Rivers. The dominant plants were *Celtis Lindheimeri, Zanthoxylum Clava-Herculis* and *Rosa bracteata. Celtis Lindheimeri* was most common in arroyos (freshwater) and brushlands of Texas (Correll and Johnston 1970). *Zanthoxylum* was common in eastern

Texas forests and *Rosa bracteata* is a native of China that has escaped from cultivation (Ibid.). The understory of these islands also reflected the freshwater influence. Common understory plants included *Medicago polymorpha, Scutellaria muriculata, Plantago Hookeriana,* and *Melilotus indicus*.

269. After a fresh dredged material deposit was dumped on Scott Bay Island #2, the pioneer plant was primarily *Sesbania Drummondii*. This species sprang up over the entire area of fresh deposition and reached a height of 0.9 to 1.2 m within 8 months. The simultaneous germination of *S. Drummondii* on the entire deposit indicated that the seeds were contained in the dredged sediment. If viable seeds were contained in dredged material and the seeds germinated within a year from the date of deposition, then the process of succession would be much more rapid than noted for the islands in the Gulf oriented bays.

Bird Colonies

270. Forty-six bird species were known to nest on the dredged material islands in both study areas (Appendix G). A total of 33,627 pairs of 25 species of colonially nesting seabirds and wading birds nested on dredged material islands in the two specific study areas (Table 2). An additional 42,658 pairs nested on natural islands in the areas. The majority of the birds, 82.3 percent, were found in the northern study area, probably because the islands in the northern study area were vegetatively mature and contained a climax of larger shrubs and trees. Numbers of nesting pairs in the specific study areas increased from the 1976 census to 1977 (Table 3).

271. The following account briefly summarizes the literature and outlines the nesting parameters for each species of nesting seabird and wading bird in the two Texas study areas. A description of nest sites including major plant communities is incorporated.

White Pelican

272. South Bird Island, a natural island in the Laguna Madre has

Table 2

Estimates of Total Pairs of Colonial Birds at Nesting Sites on the Texas Coast during 1977

	Southern Area		Northern Area		Texas Coast	
Species	Dredged Sites	Natural Sites	Dredged Sites*	Natural Sites*	Dredged Sites*	Natural Sites*
White Pelican	120	58	0	0	120	58
Brown Pelican	0	0	0	0	8	9
Olivaceous Cormorant	0	0	57	106	60	106
Great Blue Heron	368	64	94	770	745	1,376
Green Heron	0	0	30	80	30	80
Little Blue Heron	4	0	7	60	17	60
Cattle Egret	443	30	3,205	1,000	7,354	1,250
Reddish Egret	133	36	27	3	202	66
Great Egret	18	22	521	1,022	743	1,686
Snowy Egret	341	18	849	706	2,104	1,326
Louisiana Heron	396	31	874	370	1,939	521
Black-crowned Night Heron	133	75	255	0	454	144
White-faced Ibis	260	57	240	242	2,362	383
White Ibis	3	0	0	820	353	2,420
Roseate Spoonbill	0	27	310	410	420	777
Laughing Gull	3,368	3,780	13,890	26,460	36,728	33,130
Gull-billed Tern	356	118	4	0	601	118
Forster's Tern	94	1	940	3,092	1,112	3,175
Common Tern	0	0	0	0	25	0
Sooty Tern	1	0	0	0	4	2
Least Tern	82	0	40	0	152	0
Royal Tern	134	170	3,000	830	11,026	1,000
Sandwich Tern	446	25	375	230	5,541	279
Caspian Tern	140	0	380	30	734	90
Black Skimmer	710	607	979	1,308	5,243	2,570
TOTALS	7,550	5,119	26,077	37,539	78,077	50,626

* Includes aerial counts

Table 3

Number of Pairs of Colonial Seabirds and Wading Birds on Dredged Material and Natural Sites During 1976 and 1977 along the Texas Coast

Species	1976 Dredged Sites	1976 Natural Sites	1977 Dredged Sites	1977 Natural Sites
White Pelican	35	250	120	58
Brown Pelican	6	6	8	9
Olivaceous Cormorant	150	120	60	106
Great Blue Heron	1,092	1,223	745	1,376
Green Heron	0	0	30	80
Little Blue Heron	35	77	17	60
Cattle Egret	10,458	1,499	7,354	1,250
Reddish Egret	563	701	202	66
Great Egret	1,416	1,722	743	1,686
Snowy Egret	2,938	1,206	2,104	1,326
Louisiana Heron	4,678	959	1,939	521
Black-crowned Night Heron	428	475	454	144
Yellow-crowned Night Heron	0	3	0	0
Least Bittern	0	21	0	0
Wood Stork	1	0	0	0
White-faced Ibis	1,932	906	2,362	383
White Ibis	538	313	353	2,420
Roseate Spoonbill	1,188	570	420	777
Laughing Gull	24,898	15,372	36,728	33,130
Gull-billed Tern	417	181	601	118
Forster's Tern	460	671	1,112	3,175
Common Tern	0	0	25	0
Sooty Tern	0	2	4	2
Least Tern	149	147	152	0
Royal Tern	6,135	2,650	11,026	1,000
Sandwich Tern	4,137	2,705	5,541	279
Caspian Tern	375	224	734	90
Black Skimmer	3,081	1,509	5,243	2,570
TOTALS	65,110	33,512	78,077	50,626

been the only known nesting site of the White Pelican on the Gulf Coast. When he visited the island in 1926, Carroll (1927) made no mention of White Pelicans nesting. The following year, however, Carroll (1930) found nests amidst cactus patches. The nests were small mounds of shell and sand, depressed in the center, with very little lining. Prior to his visits, the colony of White Pelicans on South Bird Island was probably intermittent; nesting was accomplished only in optimum years. Pearson (1921) was probably the first to describe the colony and Thompson (1932) reviewed the White Pelican nesting history of the island. In addition to the nesting population, many White Pelicans winter on the Gulf Coast (Strait and Sloan 1975) and use dredged material islands as roosting sites.

273. One hundred and twenty-five nests of White Pelicans, of which 105 contained 192 eggs, were found under the *Leucaena leucocephala* trees on Island LM 55 in the southern area. The nests were elevated round platforms of small sticks and other detritus situated on the bare ground at the periphery of the grove of trees. Some nests were adjacent to each other while others were widely separated. Nest diameter was approximately 76.2 cm with a 20.3-to 25.4-cm-diameter bowl in the center. Adults were first seen entering and leaving the trees on 7 March 1977. On 25 March, 82.9 percent of the nests contained two eggs and the rest contained only one. Some eggs were hatched by 25 May and young were leaving the nests by 16 June. Seventy-five young birds were counted and the last ones were seen on 22 July.

274. During the early portion of nesting the research team found that their presence on the island disturbed the adults to such an extent that they did not return to their nests for at least 6 hr after the team had departed the island. All research activities were postponed on the island until after the eggs had hatched and the young could move around in the nest.

275. White Pelicans did not nest in the northern study area but were common inhabitants, loafing and roosting on exposed bars and small barren islands.

Brown Pelican

276. The history of the decline of the breeding population of Brown Pelicans on the Texas Gulf Coast has been outlined by Schreiber and Risebrough (1972) and King, et al. (1977). Recently, Brown Pelicans have nested only on a natural island (Third Chain of Islands, Mesquite Bay, Aransas County) and a large dredged material island (Pelican Island, Corpus Christi Bay, San Patricio County) although historical records indicate a much more extensive breeding range (Oberholser 1974).

277. In 1977, a total of 34 young Brown Pelicans was fledged from two colonies, one on Pelican Island and another on Long Reef, a natural island in Aransas Bay. The nests were constructed as a pile of sticks placed on the ground in dense, low shrubs or in open, sandy areas. Nest building began in March and eggs were in the nests by mid-April. Egg laying has been recorded from 28 March to 1 July (Oberholser 1974). The clutch size varied from 1 to 3, the mean being 2.95 (Andersen and Hickey 1970). Aspects of nestling growth and development have been described by Schreiber (1976).

278. The Brown Pelican colonies were not disturbed during this study. Because of their endangered status, Williams (1976) recommended that visits to Brown Pelican colonies be limited. Since several local biologists were already involved in monitoring the colonies, no attempt to investigate the colonies for this study was made.

Olivaceous Cormorant

279. Prior to this study, only four nesting colonies of Olivaceous Cormorants were known in Texas. Only two of these colonies were located on islands. Vingt-et-un Island, a natural island in Trinity Bay, was the site of one colony and Sidney Island, a dredged material island on the GIWW near Port Arthur, was the other. Two additional colonies were found during this study. A dredged material island on the Trinity River Channel, TRC 2, contained 20 nesting pairs and there were 37 nests on North Atkinson Island (HSC 90).

280. Although the Olivaceous Cormorant nests in a wide variety of situations (Palmer 1962), the prerequisite for nesting on islands was

the presence of trees 3.0 to 3.6 m tall with branches above 1.8 m capable of supporting a nest. Nests were constructed in several tree species including *Tamarix* spp., *Celtis Lindheimeri* and *Zanthoxylum Clava-Herculis*.

281. Nest construction was noted as early as 16 March 1977. One nest contained an egg on 13 April, but most egg laying occurred between 1 May and 15 May. The clutch size, which varies from 2 to 6 (Palmer 1962), was 3 (mean of 20 nests) on TRC 2. The incubation period was 26 to 30 days. Most of the eggs hatched by 15 June and the young remained in the nest for approximately one month. Of 21 nests that were known to contain eggs, only eight had young that reached fledging age. The cause for the low (38.1 percent) nest success was unknown.

Great Blue Heron

282. The Great Blue Heron builds a platform nest of sticks and twigs in a variety of habitats: on the ground, in cactus, in shrubs, in trees and near both fresh and salt water. The variability of nesting sites can be determined by reference to a few of the available reports on this species (Cameron 1906, Finley 1906, Giles and Marshall 1954, Pratt 1970 and 1972a, Georing and Cherry 1971, Henny and Bethers 1971, Simersky 1971, McAloney 1973, Vermeer 1973).

283. The breeding season of Great Blue Herons begins in late January in Texas (Oberholser 1974). Pair formation has been described by Mock (1976) and Cottrille and Cottrille (1958) have characterized nesting behavior.

284. Great Blue Herons were seen pairing and courting on 5 January 1977. Their active nests, discovered on 10 February, were the first on any of the islands. They tended to nest in the taller vegetation, building their large platforms of sticks between tree limbs, on top of bushes, or on old nest platforms. Some were in thick stands of *Borrichia frutescens* near or on the ground. They nested on LM 15A, LM 55, LM 57A, LM 81 and LM 109. The average height from the ground of 28 nests was 93.7 cm; average platform diameter was 64.0 cm; average bowl diameter was 31.8 cm; and average distance to nearest nest was

111.5 cm (Table 1). Average number of eggs per nest on all islands varied between 3.2 and 3.4. Hatching success ranged from 53 to 75 percent. Young were still present in nests on 17 September 1977.

285. In the northern study area, the first nest of a Great Blue Heron was noted on 16 March 1977. Nests were located in many species of plants including *Tamarix* spp., *Celtis Lindheimeri*, *Zanthoxylum Clava-Herculis*, *Baccharis halimifolia*, *Iva frutescens* and *Opuntia Lindheimeri*. Egg laying began on 6 April 1977, and continued through 7 June with most egg laying occurring between 15 April and 15 May. The clutch size varied from 3 to 5 and averaged 3.5. Incubation period was 28 to 30 days. Information on fledging period was not collected but Palmer (1962) estimated it to be 60 days. Of 22 nests having hatched eggs, 17 (77.3 percent) nests successfully fledged young.

Green Heron

286. Nest sites and nests of the Green Heron were described by Chase (1906) and Wheelock (1906). The location of Green Heron nests varies from ground level to over 9.1 m high in trees. The nest is composed of twigs and may be used for several seasons (Palmer 1962).

287. Green Herons nested on three of the islands in the northern study area, although only one of the islands had more than five nests. The nests were located from 0.9 to 2.4 m high in *Tamarix* spp. trees. Nest occupation began in early April and eggs were first observed on 3 May 1977. Clutch size of 26 nests averaged 3.0 and the hatching success was 80.9 percent. Green Herons were most abundant on TRC 7, but also nested on TRC 2 and TRC 10.

288. One of the five nests on TRC 10 was located in a *Nerium Oleander*, an introduced shrub.

Little Blue Heron

289. Meanley (1955) and Jenni (1969) described nesting colonies of the Little Blue Heron including aspects of arrival, courtship, nest location and nest construction. Taylor and Michael (1971) added nesting information for an inland heronry in eastern Texas. The Little Blue

Heron nests solitarily or on the periphery of mixed-species heronries (Palmer 1962).

290. Little Blue Herons probably nested on LM 57A and LM 81. Their nests were never found but they were seen on 2 May 1977, and again on 23 June flying from the *Baccharis neglecta* on LM 81 and the *Tamarix ramosissima* in Island LM 57A.

291. The Little Blue Heron nested on only two of the islands in the northern study area. A total of five nests were occupied, two on Down North Deer Island and three on WB 52. The nests, which were not monitored, were constructed in dense *Iva frutescens-Baccharis halimifolia* associations near the outer edge of the island.

Cattle Egret

292. The Cattle Egret has rapidly expanded its range in North America (Sprunt 1955, Rice 1956, Davis 1960, Crosby 1972) and has become a common associate in mixed-species heronries along the Texas coast (Ramsey 1971, 1972). Weber (1975) reviewed the studies of Cattle Egret reproduction in North America.

293. Cattle Egrets nested in the taller vegetation of those islands on which they occurred in the southern study area. Breeding aggregations were first seen on LM 57A on 29 March 1977. Nests were present on 26 April and eggs were found on 3 May. In addition to LM 57A, nests were found on LM 15A, LM 55, LM 81 and LM 109. The nests were loosely constructed small platforms near the top and outer margins of trees and bushes. The placement of the nests was influenced by the late arrival of Cattle Egrets and competition with the already established species resulted. Nest height ranged between 76.2 and 243.8 cm. The average nest diameter was approximately 27.9 cm, bowl diameter 12.7 cm, and the average distance to nearest nest was 76.2 cm. Average number of eggs was 2.8 eggs per nest. Hatching success was not determined accurately on any of the islands because of the late nesting. A 75 percent success rate was determined for ten nests on LM 57A. Unfledged young were still in the nests on 17 September 1977.

294. Cattle Egrets nested on 9 of the 14 islands in the northern

study area that had mixed heronries. The nests were constructed in shrub or tree associations in close proximity to the nests of other herons and egrets. Nests contained eggs as early as 13 April 1977, which was 7 days earlier than the earliest date reported by Oberholser (1974), and nests were found with eggs through 21 July. The peak egg laying period was 30 May to 7 June, which was somewhat later than that of associated nesting species. The incubation period was 22 to 27 days, but the fledging period (approximately 40 days according to Palmer 1962) was not determined. The mean clutch size calculated for 86 nests was 3.0 eggs, which is comparable to clutch size estimates of Blaker (1969) and Weber (1975).

295. Cattle Egrets had a pronounced effect on other species nesting in the mixed heronries. Many Cattle Egret nests, which were begun later than those of other species, were constructed of materials taken from the nests of the heronry associates. This effect, also noted by Dusi and Dusi (1968), was most pronounced on TRC 2 where entire nests of Great Blue Herons, Louisiana Herons, Great Egrets, Snowy Egrets and Roseate Spoonbills were stolen. The eggs or young of the usurped nests dropped to the ground and perished.

Reddish Egret

296. The Reddish Egret nests almost exclusively in coastal areas near salt water. In Texas it nests on coastal islands in brushy thickets (Palmer 1962). It constructs a nest platform of sticks, twigs or rootlets atop yucca, cactus or dense shrubs or on the ground. McMurray (1971) has described typical nest sites and composition along the lower Texas coast.

297. Reddish Egrets used the islands in the southern part of the southern area, LM 57A, LM 57, LM 105 and LM 109. They were first seen on 8 March and nests and eggs were observed on 2 May 1977. The nests were usually less than 30.5 cm above the ground in dense stands of *Borrichia frutescens*. The nests, constructed of loosely meshed twigs and *B. frutescens* stems, ranged in width from 0.4 to 0.6 m with a negligible cup. Distance to nearest nest averaged 144.8 cm. The average number of eggs in 15 nests was 3.6 eggs per nest. Hatching success was not

determined. Four fledglings were present on LM 81 on 27 August 1977.

298. Reddish Egrets nested on three study islands in the northern study area: two nests on Bulkhead Reef (HSC 76), 12 nests on WB 52, and three nests on WB 52A. All of the nests were constructed in large shrubs of either *Iva frutescens* or *Baccharis halimifolia.* The first egg was noted on 10 May 1977, and egg laying continued through mid-June. Clutch size averaged 2.7 eggs. Only 37.5 percent of the eggs hatched. Of the 9 nests that hatched eggs, four nests (44.4 percent) had young that fledged. The fledging period was approximately one month.

Great Egret

299. The Great Egret requires large areas of shallow water for feeding and woods or thickets with sturdy vegetation for nesting (Palmer 1962). Nest sites have been described by Bent (1904) and Pratt (1970, 1972a, 1972b). Wiese (1976) described aspects of pair formation, courtship and nest site selection.

300. A total of 11 pairs of Great Egrets nested on LM 15A and LM 81 during 1977. They were first seen on 7 March and nests with eggs were observed on 2 May. The nest platforms were large, with a lining of herbaceous material. The average height was 104.1 cm, the average diameter of the nest was 55.9 cm and average distance to nearest nest was 86.4 cm. The average number of eggs per nest was 2.3 and the hatching success was 66.7 percent. Fledglings were present on the island on 27 August 1977.

301. In the northern study area, Great Egrets nested on 10 of the 14 islands that contained mixed heronries. Nest sites were variable, ranging from ground nests on Rollover Bay #1 to nests in shrubs, usually *Baccharis halimifolia, Iva frutescens,* and *Lycium carolinianum,* to trees, including *Tamarix* spp., *Celtis Lindheimeri* and *Zanthoxylum Clava-Herculis.* On Scott Bay #3 a few nests were located in dense *Rosa bracteata* brambles. Egg laying began in late April and continued through late June. The mean clutch size of 86 Great Egret nests was 2.8. Nest success was 72.8 percent.

Snowy Egret

302. The Snowy Egret nests from ground level to over 9.1 m high in trees (Bent 1904, Teal 1965, Jenni 1969). In some cases, nest placement can be used to distinguish Snowy Egret nests from those of other wading birds (Ralph and Ralph 1958).

303. Snowy Egrets nested in the bushes and trees of islands LM 15A, LM 55, LM 57A, LM 81 and LM 109. Some also nested on the thick growths of *B. frutescens* or *Opuntia Lindheimeri* on these islands and in similar vegetation on LM 105. They were first observed on the islands on 21 March and nests with eggs were found on 3 May. The nests were built low in the vegetation, from ground level to 1.2 m. The platforms were constructed of loosely woven sticks and usually no closer than 0.6 m from each other. Nest diameters for 5 nests averaged 27.9 cm. Average number of eggs in all nests on all islands was 3.1 eggs per nest. Hatching success was 77 percent. Three unfledged chicks were seen on 27 August 1977, on LM 81.

304. In the northern study area Snowy Egrets nested on 13 of 14 islands that contained mixed heronries. Snowy Egrets nested in shrubs and trees but most often selected clumps of *Opuntia Lindheimeri*, especially in situations where the latter was surrounded by dense vegetation. Egg laying began in late April and continued through June. Clutch size for 38 nests was 3.1 eggs and hatching success was 66.1 percent.

Louisiana Heron

305. Nesting colonies of Louisiana Herons have been described by Bent (1904), Erichsen (1921), Christy (1928), Teal (1965) and Jenni (1969). Nesting habits vary from participation in large, mixed wading bird colonies to solitary nesting. In Texas, nests are constructed as a platform of plant stems and grasses on the ground, in dense shrubs or in trees (Oberholser 1974).

306. Louisiana Herons were first seen in migratory flight on 24 March over LM 57A in the southern study area. The first nests and eggs were discovered on 3 May 1977, on LM 57A. The nests were built in *Borrichia frutescens* dominated communities on LM 57A, LM 81, LM 105,

LM 109 and LM 111. The nests, built of sticks with some herbaceous linings, were supported by thick stands of *B. frutescens* and were 0.3 to 0.9 m above ground. Average nest diameter for 16 nests was 25.4 cm; average bowl diameter was 15.0 cm for 13 nests. There were 2.6 eggs per nest in the 41 nests that were counted.

307. Hatching success was 95.4 percent for those eggs on LM 57A and 50 percent for those on LM 81. Four recently fledged Louisiana Herons were found on 9 September 1977, on LM 111.

308. Louisiana Herons nested as solitary individuals on some islands in the northern study area, as members of a nearly "pure" species colony and as members of mixed heronries. When nesting individually, nests were constructed 0.3 to 0.6 m above the ground in dense stands of *Borrichia frutescens* or in isolated clumps of *Opuntia Lindheimeri* or *Baccharis halimifolia*. Louisiana Herons on Down North Deer Island in West Bay nested in a *Borrichia-Baccharis* association. In mixed heronries, Louisiana Herons nested in both shrubs and trees. Because Louisiana Herons can nest in low shrubs such as *Borrichia* spp., they were often the first species of wading bird to utilize a recent dredged material island as a nest site. Louisiana Herons, for example, nested on the Jigsaw Islands which were only four years old.

309. Nest building was first noted on 6 April 1977, and the first eggs were found in a nest on 13 April. Clutch size, calculated for 43 nests, was 2.6. Hatching success was 59.1 percent after an incubation period of approximately 24 days. Young successfully fledged from 45 of 63 nests (71.4 percent) in which eggs were hatched. There was some indication that solitary nests were not as successful as nests in mixed colonies, but these data were not significantly different.

Black-crowned Night Heron

310. The nesting behavior of the Black-crowned Night Heron was described by Noble, et al. (1938), Allen and Mangels (1940) and Noble and Wurm (1942). Nest site descriptions have been provided by many authors. In Texas the species nests in dense *Phragmites* spp. stands in clumps of grass on dry ground, in salt-cedar, mesquite and huisache

(Oberholser 1974).

311. Black-crowned Night Herons were first seen on 5 January 1977 on LM 15A in the southern study area. The first nests and eggs were found on 22 March. The nests were constructed in *Prosopis glandulosa, Baccharis neglecta, Leucaena leucocephala, Tamarix ramosissima* and *Typha domingensis* on islands LM 15A, LM 55, LM 57A and LM 105. Nest heights ranged from 0.3 to almost 2.4 m. Most nests were built in the interior of the trees of sticks and herbaceous material. Average diameter of 11 nests was 43.4 cm, average bowl diameter was 19.0 cm, and average distance to nearest nest was 108.7 cm. The average clutch size for 58 nests was 3.2 eggs per nest. The hatching success of 66.7 percent was determined for seven nests on LM 15A. Two fledged individuals were seen on LM 15A on 17 September 1977.

312. Black-crowned Night Herons were common mixed heronry inhabitants in the northern study area, nesting on 11 of 14 islands with wading bird colonies. Nesting habits were variable. They nested in dense *Iva frutescens-Baccharis halimifolia* associations, in *Tamarix* spp., in *Rosa bracteata* brambles and in the tree communities on HSC and Trinity Bay islands. Nesting began in late March and continued until late July. Clutch size for 68 nests was 2.9 eggs and 64.3 percent of the eggs hatched. At least one young fledged from 84 of the 100 nests (84 percent) in which eggs hatched.

White-faced Ibis

313. Nesting colonies of the White-faced Ibis are usually located in close proximity to freshwater marshes, sloughs and rice-fields, the preferred feeding habitat (Oberholser 1974). Nests are constructed in dense stands of low shrubs or tules (Bent 1926).

314. White-faced Ibis were first seen in migrating groups on 24 March 1977, in the southern study area. Nests with eggs were found on 2 and 3 May on LM 57A, LM 81 and LM 105. Their nests were usually built on or near the ground in the *Borrichia frutescens* dominated communities. The average height of 15 nests was 10.7 cm. The average nest diameter for 13 nests was 31.2 cm and the bowl diameter average of 9 nests was

17.8 cm. The nests were constructed an average of 149.4 cm from the nearest nests. Of 65 nests surveyed, an average clutch size of 3.1 eggs per nest was determined. Because the young are virtually precocious and are able to leave the nest shortly after hatching, hatching success was indeterminable. Fledgling White-faced Ibis were last seen on 27 July and they were on LM 57A.

315. White-faced Ibis nested on Little Pelican Island in the northern study area. The nests, 0.3 to 0.6 m above the ground in dense clumps of *Borrichia frutescens*, were scattered over the entire island. Nest construction began in early April and eggs were present in the majority of the nests by 3 May 1977. Clutch size was 2.3 eggs but hatching success was only 28.6 percent. The low hatching success was probably biased because the nestlings abandoned the nests when disturbed and hid in the dense vegetation.

White Ibis

316. The White Ibis consistently nests near the coast in salt-, brackish-, and fresh-water areas (Palmer 1962). In Texas the White Ibis nests in trees along bayous, in prickly pear, in *Baccharis* and in tall grass stands (Oberholser 1974). Nest site selection has been studied by Kushlan (1976).

317. Three pairs of White Ibis nested in the *Tamarix ramosissima* in the north-central portion of island LM 57A in the southern study area. Their nests were constructed approximately 0.6 m above the ground under a canopy of overhanging limbs. The nests were constructed of sticks with interwoven herbaceous material. No nest measurements were taken. Each of the three nests contained two eggs. Two chicks were hatched in the single monitored nest. These two chicks were fledging on 16 June. The other two nests were discovered on 22 June and were not checked after that date.

318. A large colony of White Ibis nested on a large natural island, North Deer Island, in West Bay in the northern study area. This island is protected by the National Audubon Society so no nests were monitored. White Ibis did not nest on any dredged material island in the northern

study area.

Roseate Spoonbill

319. The Roseate Spoonbill, a species which formerly declined in numbers on the Texas coast (Allen 1935a, 1935b, 1942, 1952, Sprunt 1938), nests on coastal islands and in inland heronries. The nest is a platform of sticks in *Phragmites* marshes, huisache, mesquite, sea myrtle, oleanders and prickly pear (Oberholser 1974).

320. The Roseate Spoonbill nested on four study islands in the northern area. On three of the islands, TRC 2, North Atkinson Island and Scott Bay #3, the nests were located in *Celtis Lindheimeri, Zanthoxylum Clava-Herculis* and *Tamarix* spp. trees. On Pelican Island the nests were constructed in tall stands of *Baccharis halimifolia*. The first eggs were noted on 30 April 1977, and by mid-May most of the clutches were complete. The average clutch size for 77 nests was 3.0 eggs of which 63.9 percent hatched. The incubation period, 22 to 24 days, was consistent with that stated by Allen (1942). The young birds left the nest in five to six weeks but remained in the area and were fed by the parents for several weeks thereafter. The young are probably capable of flight when they leave the nest (Palmer 1962).

Laughing Gull

321. Laughing Gulls are found year round on the Texas coast and are the only gull species that nests in Texas. Laughing Gulls nest in colonies located in dense, low shrubs or herbs. Factors influencing nest site selection have been described by Bongiorno (1970) and Burger (1976). Other aspects of social behavior and territoriality within colonies were characterized by Noble and Wurm (1942), Burger and Beer (1975) and Hatch (1975).

322. Breeding aggregates of Laughing Gulls were first seen on 16 February 1977, near LM 15A in the southern study area. The first nests and eggs were found on 3 May on LM 57A. They nested on eight of the 14 islands on which birds nested, LM 15A, LM 55, LM 57, LM 57A, LM 81, LM 105, LM 109 and LM 111. The nests were constructed on the ground near

the shore or in slightly higher grassy areas and were usually placed under some type of plant for shade. Associated plants were *Andropogon glomeratus, Baptisia leucophaea* and *Borrichia frutescens*. There were as many as four nests under some of the larger *B. leucophaea*. Nests were separated by distances from 0.3 to 4.6 m. The nests were woven grass bowls 15.2 to 20.3 cm in diameter with a depth of approximately 5.1 cm. There was an average of 2.4 eggs per nest in the 113 nests that were counted. Because of the precociousness of these birds and the density of the vegetation, there is no information on hatching success. Fledglings were last seen on the islands on 17 September 1977.

323. Laughing Gulls nested on Little Pelican Island and on the Jigsaw Islands in the northern study area. Nest sites were commonly located among the bases of dense stands of *Borrichia frutescens* or *Chenopodium albescens*. On Little Pelican Island nests were concentrated near large open areas that were interspersed in the *B. frutescens* community. Nests of Laughing Gulls were also constructed on wind-blown mats of *Spartina spartinae* and *Spartina patens* on Little Pelican Island.

324. Nesting in the northern area began on 2 April 1977, and the first eggs were laid on 29 April. The clutch size was 2.2 eggs per nest. Other nesting data were not obtained because the young gulls abandoned their nests at the slightest disturbance and they were impossible to locate in the dense vegetation. However, nest success on Little Pelican Island was probably very low due to adverse weather shortly after the majority of the young gulls were hatched.

Gull-billed Tern

325. The Gull-billed Tern nests on sandy islands on the coast of Texas. It makes a shallow depression in the sand and lines the nest with fish bones, small shells and fragments of *Sesuvium Portulacastrum* (John M. Leach II, undergraduate student, Corpus Christi State University, Corpus Christi, Texas, personal communication). Nests are located in bare or sparsely vegetated areas (Pemberton 1927).

326. Gull-billed Terns were first observed in the southern study area on 21 March 1977. The first nests were found on 2 May and were on

LM 105. Seven nests contained eggs on 2 May. Gull-billed Terns nested on LM 15A, LM 43A, LM 57, LM 57A, LM 81, LM 105 and LM 111. Vegetation of the nesting sites was relatively sparse and consisted of various grasses such as *Sporobolus* spp., *Cenchrus* spp., and *Chloris petraea*, and other flowering plants such as *Hedyotis nigricans, Oenothera Drummondii* and *Iva angustifolia*. These birds are ground-nesters and usually selected substrates of coarse sand and shell or serpulid reef material. The nests were lined with shell fragments and were approximately 15.2 cm in diameter. The distance of 10 nests from each other or from Black Skimmer nests averaged 0.9 m. The average number of eggs in 77 nests was 1.8. There was 27.9 percent hatching success for 20 nests, 10 on LM 57A and 10 on LM 15A. Most young had fledged by 28 June on all islands.

327. Fewer Gull-billed Terns nested in the northern study area in 1977 and no nests were monitored.

Forster's Tern

328. The nesting habits of Forster's Terns vary with location. Bent (1921) cited descriptions of scrape nests in barren, sandy areas, floating nests on masses of decaying cattails and nests on piles of windrows of drift debris at the edge of marshes. Bergman et al (1970) also reported considerable variation in nesting substrate and that Forster's Tern nests tend to be on dry sites, well above water.

329. Although no Forster's Terns nested on any of the study islands in the southern area, they were discovered on an unstudied dredged material island. They were found on 10 June 1977, on LM 65 on nests placed among the low halophytes. The nests were low platforms constructed from the leaves of the herbaceous plants on the island. The nearest nest was usually 0.6 to 0.9 m away and was of another Forster's Tern or occasionally a Gull-billed Tern. The 61 nests contained 124 eggs and 1 chick or an average of 2.1 eggs per nest. The island was not visited often enough to determine hatching success. On 7 July there were eggs, young and ten adults still on the island.

330. Forster's Terns nested successfully on Rollover Bay Island #1

in the northern study area. Unsuccessful nesting attempts were made on Jigsaw Island and Bulkhead Reef where storm tides destroyed the colonies. The successful colony was begun in early April 1977. Nests were constructed on blown-over *Spartina alterniflora* clumps and on dry rafts of drift material near the edge of the island. The clutch size was 2.3 eggs per nest and hatching success was 12.5 percent. Heavy rain may have destroyed many nests near the end of the incubation period. The incubation period was approximately 23 days.

Sooty Tern

331. A single pair of Sooty Terns nested on Island LM 57A under a *Borrichia frutescens* and *Coreopsis cardaminaefolia* canopy in the southern study area. The nest was first found on 17 May 1977, with one egg and by 25 May the egg had hatched and the young had departed the nest. Both parents were still in the area and were probably maintaining the chick in some area away from the nest.

Least Tern

332. The Least Tern nests on bare ground (Tomkins 1959). The nest, a shallow scrape usually lined with shells, is typically spaced widely from other Least Tern nests (Bent 1921).

333. Least Terns characteristically nested on the more barren areas away from all other bird species. Often Black Skimmers would move into their nesting area and nest with them. A single egg was found in a scrape on the high barren sands of the diked area of LM 43A on 19 April 1977, in the southern study area. Other nests with eggs were found on LM 47, LM 47.5, and LM 51 on 3 May. All were gone on 10 May, probably the result of a storm on 9 May. Only LM 47 was used as a nest site after this date but these nests were also unsuccessful. On 2 June 34 nests with a total of 60 eggs and young were counted on a newly formed island, LM 72. The fine sand from the construction of a private channel was formed into a low mound on which the terns constructed their nests. Since the island was not a study island, it was not regularly checked. On 7 July seven active Least Tern nests with ten eggs were found and

Black Skimmers and a pair of Gull-billed Terns had joined them and were nesting.

334. Least Terns did not nest on study islands in the northern specific area.

Royal Tern

335. Royal Tern colonies are commonly located on inaccessible bare areas, particularly dredged material islands (Buckley and Buckley 1972). Nest sites are scrapes dug into the substrate. Most colonies are located near the apex of an island or, at least, on a slight slope. The nests are commonly spaced in tightly fitted, hexagonal-shaped territories which increase the number of nests that can be packed into a limited area of suitable habitat (Buckley and Buckley 1977).

336. Royal Terns, like most of the other terns, used bare sand and shell areas on the islands as nesting sites. They were first seen in the southern study area in breeding groups on 25 May 1977, on the artificially cleared dome of LM 57 in association with a group of Sandwich Terns. The nests were small scraped depressions in the substrate within 0.3 m of each other. There were 52 nests on the island and based on 10 marked nests, 90 percent of the nests contained 1 egg. Hatching success was probably high, judging from the numbers of chicks that were herded onto the beaches by their parents.

337. The Royal Tern colonies were formed in early April in the northern study area. The first eggs were observed on 29 April 1977, and hatching began on 31 May. The incubation period was 28 to 31 days. The usual clutch was one egg, rarely two. Hatching success on the Jigsaw Islands was 79.3 percent. Within 24 hours of hatching, young Royal Terns were able to abandon the nests and would congregate in large creches of mixed tern species. Individuals in the creches would paddle between islands when disturbed and creches from adjoining islands would intermingle. Thus, it was impossible to determine fledging success or other nesting parameters.

Sandwich Tern

338. The Sandwich Tern often nests in company with Royal Terns or Black Skimmers. The adaptive advantage of its close association with the Royal Tern has been discussed by Buckley (1972) and Soots and Parnell (1975). Nest site preferences, therefore, are similar to those of its nest associates, namely sparsely vegetated areas on sand-shell substrates. Aspects of the breeding biology and development of the young have been discussed by Buckley (1972), Langham (1974), and Dunn (1975).

339. Sandwich Terns were similar in nesting habits and parallel in nesting chronology to the Royal Terns. They nested with the Royal Terns on both of the artificially cleared areas on LM 57 in the southern study area. On 10 June 1977, 434 nests were counted with 95 percent containing one egg. The nests are, in all respects, similar to those of the Royal Tern. Hatching success and fledging success were probably substantial, as many chicks were seen in shoreline creches.

340. Approximately 375 pairs of Sandwich Terns nested with Royal Terns on the Jigsaw Islands in the northern study area. Nests contained eggs on 29 April 1977. The clutches usually consisted of one egg. Hatching occurred simultaneously with the Royal Terns and 78.2 percent of the Sandwich Tern eggs hatched. The young abandoned the nests within two days after hatching and joined mixed species creches.

Caspian Tern

341. Pemberton (1922) was among the first to describe Caspian Tern colonies in Texas. He noted that the nests are more widely spaced than those of Royal Terns or Sandwich Terns and that the nests are composed of a shallow scrape into which grass and mud are compressed to form a dish. In some areas, Caspian Terns make open scrapes in bare island areas (Bent 1921).

342. Caspian Terns nested in low numbers on several islands in the southern study area, one pair on LM 51, 59 pairs on LM 57, and one pair on LM 81. The first nest was found on LM 57 and contained two eggs. The nests on LM 51 and LM 57 were located in the high barren sand and shell fragment areas near the highest point on the islands. The pair on

LM 81 built their nest on the low sand spit on the southwestern end of the island. The nests were simple unlined depressions and were within 0.6 m of each other on LM 57. On this island, they nested in conjunction with Royal Terns and Sandwich Terns. There was an average of 1.7 eggs per nest in the 61 nests on the study island. Hatching success was 75 to 100 percent on the three islands and fledging success was probably high. The one nest with two eggs was still present on LM 81 on 23 June.

343. Approximately 50 Caspian Tern nests were located on WB 37. Many were scattered among Royal Tern nests but a few were on the periphery of mixed tern colonies. The peripheral nests were always adjacent to patches of dense vegetation. Because of the difficulty in distinguishing Caspian Tern nests from those of Royal Terns, no Caspian Tern nests were monitored in the northern study area.

Black Skimmer

344. The Black Skimmer is a colonially nesting species that selects open sand or shell beaches or bars (Bent 1921). The nest is a scrape in areas of sparse vegetation or devoid of plants. Breeding behavior and nesting ecology were described by Wolk (1959) and DePue (1974).

345. The nesting activities of this bird were one of the most difficult of all to follow. Their first efforts usually ended as futile attempts because human disturbance or high tides forced them to abandon their nests. They were first seen in the southern study area on 4 February 1977, but nests with eggs were not found until 2 May. Their nests were found on LM 15A, LM 43A, LM 57, LM 63A, LM 81, LM 105 and LM 111. Nests were simple scrapes in shore areas of sand and shell just large enough to fit the body of a skimmer. When vegetation was present, it consisted of isolated plants of *Oenothera Drummondii* and *Heterotheca subaxillaris*. The bare areas that were selected were usually near the shore during the earlier part of the nesting season and at higher elevations later. Nests were usually separated from those of other skimmers by 0.6 to 0.9 m. The average number of eggs in 116 nests was 2.8. Hatching successes ranged from 80.6 percent on LM 15A to 25 percent on

LM 63A. Unfledged chicks were last seen on 27 August on LM 63A.

346. In the northern study area Black Skimmers nested on three study islands: Jigsaw Island, Smith Point #1 and Rollover Bay #1. The Jigsaw colony, consisting of only six nests, was destroyed by waves and was not re-established. The Smith Point colony was also destroyed in June 1977, but was re-established in a higher area on a shell bank. The largest colony, 350 pairs, was located on Rollover Bay #1. This colony was situated in an open sandy area at mid-island. Nesting began in early April 1977, and continued through May. Clutch size averaged 3.3 eggs and hatching success was 58.0 percent.

347. A later colony was begun on Smith Point #1 in August. Approximately 20 pairs of Black Skimmers dug scrapes and two nests each contained one egg on 26 August. No further visits were made to this colony in 1977.

Island, Vegetation and Bird Associations

348. There were approximately 413 dredge-built or dredge-modified islands and 72 natural islands along the Texas Gulf Coast. The majority of the dredge-influenced islands were adjacent to USACE-maintained waterways, but there are many dredged material islands resulting from private channel construction. Both dredged material islands and natural islands serve as nesting habitats for a major portion of the colonial seabirds and wading birds that nest on the Texas coast. On a yearly basis approximately 60 percent of the nesting pairs have used dredged material islands for nest sites.

349. Dredged material islands continue to be built, although the rate of construction of new islands has decreased drastically. In some Texas coastal areas the construction of islands has terminated in favor of depositing dredged material into diked land banks. Land disposal sites, although conducive to nesting passerines (Coastal Zone Resources Corporation 1977), have not functioned as nesting habitats for colonial seabirds and wading birds.

350. The deposition of dredged material onto existing dredged material islands, natural islands or newly formed islands created a substrate initially devoid of vegetation. The pattern of invasion of plants onto these new deposits was consistent and can be described in general terms. The usual sequence included the initial establishment of pioneer plants on tidal drift lines. Within two to five years the lower portions of the islands were invaded by perennial grasses and forbs. The time required for the establishment of annual, biennial and perennial grasses and forbs on the upper slopes and domes of the islands was related to rainfall patterns, which varied geographically along the Texas coast, and island apex elevation. Complete plant coverage of the upper elevations took two to four years in the northern study area and 20 to 30 years in the more xeric southern area.

351. Climax vegetation varied by region in Texas. In the southern study area the climax was represented by stands of grasses and herbs unless invaded by mesquite shrubs which dominated the island apex. In the northern area two climaxes were observed. On islands in the bays which received limited freshwater inflows, a dense shrub community was dominant. However, on islands situated in bays that received large amounts of freshwater characteristically there were tree communities. The trees were species that were typical of mesic eastern Texas forests.

352. Several factors regularly altered the typical pattern of succession. Along boat channels and in the middle of large bays, constant wave action eroded island perimeters preventing the establishment of vegetation in the lower part of the island. In the northern study area piles of oyster shells accumulated on the wave-fetch side of islands and vegetation did not become established on oyster banks. In most locations, however, succession of vegetation was usually predictable.

353. Colonially nesting seabirds, wading birds, and shorebirds exhibited patterns of nesting succession that were closely related to succession of vegetation. Nesting birds were grouped as those preferring: (1) bare or nearly bare substrate, (2) sparse to moderate cover of low forbs, (3) dense forbs, and (4) shrubs, dense shrubs or trees. Some

species of birds nested in two or more of these situations on various islands.

354. Seven species of terns and the Black Skimmer nested on the ground in barren areas. These birds dominated fresh deposition sites on new and old islands and also nested on areas that were otherwise devoid of vegetation. The first birds to appear on fresh dredged material in both areas were Least Terns. They were quickly joined by Black Skimmers and, in the southern area, by Gull-billed Terns. On the older barren sites Caspian Terns were the first to occupy the area usually near the summit of the mound. Often, they were joined on the slopes by Royal Terns and in turn by Sandwich Terns.

355. Several of the species showed an affinity for nesting near other species. For example, Royal Terns nested in either mixed or pure colonies, but Sandwich Terns nested only in association with Royal Terns. As the density of grasses and forbs increased, some of these species selected more barren areas.

356. Few species nested in low sparse forbs. Occasionally, Common Tern, Gull-billed Tern, Laughing Gull and Black Skimmer colonies would be found in such areas but these species seemed to prefer more barren places. Laughing Gulls that usually nested in dense forbs were occasionally found in these areas. The only species that showed a preference for low forbs was Forster's Tern, which nested on wind-blown mats of *Spartina* sp. or on tidal drift accumulations.

357. Areas of dense forbs attracted Laughing Gulls, Brown Pelicans, Louisiana Herons, Reddish Egrets, White-faced Ibis and some Great Blue Herons. Laughing Gulls nested in large numbers in these situations. Usually the dense forb community was dominated by *Borrichia frutescens*.

358. Most of the wading birds preferred dense shrubs or trees for nesting sites and would nest in either type of vegetation. Cattle Egrets, Little Blue Herons, Green Herons, White Ibis, Roseate Spoonbills and Olivaceous Cormorants nested exclusively in these two types of nesting sites. The cormorants preferred tree sites 2.4 to 3.0 m above the ground.

359. Some species, such as the White Pelican, nested in different situations on different islands. On South Bird Island they nested in

barren areas adjacent to dense, low forb communities. However, on LM 55 they nested on the ground beneath the cover of a tall shrub community. The area beneath the tall shrubs was generally devoid of understory vegetation.

360. Wading birds affected their colony sites significantly by fertilization. In most cases there was little herbaceous vegetation beneath heronries but this was due, in part, to the density of the vegetation that was being nested upon. No cases were found where the shrubs or trees were killed or stunted by the concentration of guano accumulation.

361. Laughing Gulls considerably altered some of their nesting areas by trampling lanes or avenues between nest sites. The effect of the trampling appeared to be only temporary and the vegetation appeared normal in density and height within 6 to 8 months after nesting.

362. One factor noted in the southern area was "site tenacity" exhibited by the nesting birds and its influence on the colonization of dredged material islands. Three areas of dredged material islands along the GIWW supported 90 percent of the birds that nested on such islands in the southern area. Approximately ten years ago a natural island, Demit, that supported a large nesting population of wading birds was invaded by coyotes, *Canis latrans* (Say) (Dr. Henry Hildebrand, Professor of Biology, Texas A&I University, personal communication). Demit Island is located in the northern Laguna Madre at its junction with Corpus Christi Bay near GIWW islands LM 3A-15A. In the past five years there has been an increase in nesting on these islands where there once was none. There has been little or no nesting on Demit Island for the past ten years because of the coyotes that are still present. Site tenacity was illustrated more obviously along that part of the GIWW near South Bird Island. The numbers and species on nearby dredged material islands have increased in the past few years. It is presumed that these birds have moved from South Bird as have the White Pelicans that nested on LM 55 during the last two years. The other area included the islands LM 103-113 located at the mouth of Baffin Bay. When these islands were constructed there was a large nesting colony on the mainland (hearsay). This colony was

no longer in existence and it is presumed that the original colonizers of this series of dredged material islands came from this mainland colony.

363. The effects of predation, particularly mammalian predators, were limited on dredged material islands due to their isolation. Few predators were observed during this study but snakes, raccoons, coyotes, badgers and various rodents may have preyed upon the birds or their eggs and young.

364. The presence of people on islands, especially in the southern area, was an important element in the lack of success of nesting species on certain islands. However, on other islands with long-established cabins and active sports persons, limited nesting was successful if the nests were far enough removed from the cabins.

365. The periodic but regular deposition of dredged material on islands maintains the early successional stages necessary for many species (Soots and Parnell 1975a) and some of these stages are important as nesting sites for birds. These islands are important areas in the nesting ecology of colonial seabirds and wading birds.

Management Recommendations

366. The use of dredged material islands as nesting sites by colonial seabirds and wading birds is increasing as ancestral colony sites are becoming overcrowded, changing vegetatively, or are usurped and disrupted by human activities. Since dredged material islands are important to the nesting ecology of many species, it is important to consider several basic questions before discussing recommendations for managing the islands:

- a. Should more islands be constructed in Texas? We think not. If additional bottom area in the bays is covered by dredged material, the bays may not support sufficient food chains for the existing birds.
- b. What effect does the creation and existence of a dredged material island have on a bay or estuarine system? The answer is not fully known and deserves detailed study.

Circulation patterns in both the upper and lower Laguna Madre have been altered by the existence of long chains of connected islands. The resulting local hypersalinity has caused high fish mortality which could affect nesting success of fish-eating birds. Thus, it is important to determine the effect of deposition on bay systems.

c. Does the USACE adequately control and monitor the dredging and deposition activities along the Texas coast? We found that the district office was not aware of the actual deposit site in dredging operations. Most maintenance dredging is done by contractors. Contractors and other permit dredgers are given designated zones, some of which may be five miles long, into which dredged material may be placed. There are no records, other than general dates of dredging and the zone in which it was done, of the deposition of the dredged material - is the dredged material deposited on an existing island or is a new island formed? Furthermore, permits are issued for many private channels for which there are no records of channel completion or dredged material deposition. In some instances channels are dug without the knowledge of the USACE.

367. The answers to these questions partially influence recommendations for the creation and management of dredged material islands in Texas. Based upon this study, the following recommendations for management are made:

a. The staff of each district USACE office should include at least one biologist, whose responsibility is to monitor dredging activities and provide "on-site" consultation to minimize the effects of dredged material deposition. Placement of dredged material could be more effectively controlled and recorded.

b. No additional dredged material islands should be constructed, unless otherwise impossible. All future depositions should be made on existing islands.

c. Dredging activities should be controlled in terms of time. Dredging activities during the period from 1 February to 31 August are potentially harmful to nesting seabirds and wading birds. Deposition of dredged material during this period should be allowed only on those islands that show no sign of use as nesting sites for colonial seabirds and wading birds.

d. Island size should be limited. Dredged material islands should be no smaller than 2 ha and no larger than 20 ha. If correct elevations are maintained, this size range provides optimum habitat diversity without being large enough to support a predator population. Larger islands may also be vegetated more rapidly since the chance of plant propagules would be more likely to reach the island (Mendoza 1974, Ortiz 1974). Most nesting birds were concentrated on the larger islands.

e. The placement of dredged depositions should be controlled to provide maximum habitat diversity. Each island should have components of each major community type: barren areas, low forbs, dense shrubs and trees. Therefore, deposits should not be made on the areas of older, climax vegetation. Addition of deposits to existing islands would provide areas of new habitat that would take advantage of the process of vegetation succession and thus maximize avian usage.

f. The height and slope of deposits should be limited. McMurray (1971), Simersky (1971), DePue (1974), Mendoza (1974) and Ortiz (1974) suggested that island elevations be higher than 0.9 m but no higher than 2.4 m above high tide. These elevations supported vegetation that was conducive to nesting by colonial seabirds and wading birds. Island heights above two meters tend to be bare but are not suitable nest sites because of blowing sand. Slopes on dredge islands should be gradual, not more than one meter of rise per 30 linear meters. Gentle slopes are important to birds that nest in bare areas and pioneer vegetation.

g. Deposition of dredged material exclusively in land banks should be terminated. In the northern study area some islands are eroding away because all depositions are now made in land banks. Land disposal areas become nesting sites for many passerine birds but are not utilized by colonial seabirds and wading birds. In most instances, for example, the Rollover Bay Islands, dredged material could be added to the leeward side of the islands without consequential effects on sediment erosion into the channel. Succession of vegetation would occur more rapidly if the fresh material were added adjacent to existing, vegetated sites and the vegetation would stabilize the island. If land banks are used exclusively, many important nesting sites for colonial seabirds and wading birds will be lost.

h. Human encroachment and use of the islands should be restricted during the breeding season. In general, islands that were heavily used by humans during the avian breeding season were not used by birds as nest sites, or if they were used, nest success was low. Human use of the islands should not be restricted during other portions of the year so long as no more than limited alteration of the habitat occurs. Certainly, no areas of climax vegetation should be altered nor should human structures be constructed in nesting habitat. A more stringent permit program by the General Land Office of Texas must be initiated at the request of the USACE.

i. The USACE-WES should fund additional studies of aspects of dredged material islands. Suggested studies include: (1) the effect of dredged material islands on shore and long-term bay productivity, (2) the management of dredged material island habitats by methods such as planting, clearing, burning and fertilization, (3) the effect of dike height on vegetation and avian succession on diked islands, (4) the relationship between the island water table, soil characteristics and vegetation, and (5) methods of stabilizing dredged material islands that are subject to extreme wave erosion.

368. Because data are lacking on these factors, the authors are unable to comment on management aspects relating to these questions. For example, Island 47 was recently diked with 4.6-m-high dikes. Indications are that this island will become vegetated more slowly than an island with lower dikes and it will be less conducive to nesting because of blowing sand. With additional data, recommendations concerning planting the island with *Prosopis* spp. or *Baccharis* spp. for stabilization and for nesting habitat may be appropriate.

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APPENDIX A: NESTING STIES ON THE TEXAS COAST USED BY COLONIAL AND WADING BIRDS IN 1976

List of abbreviations used in this Appendix

AA	American Avocet
AO	American Oystercatcher
BCNH	Black-crowned Night Heron
BP	Brown Pelican
BS	Black Skimmer
CE	Cattle Egret
CaT	Caspian Tern
CoT	Common Tern
C?	Cormorant (Species unknown)
E?	Egret (Species unknown)
FT	Forster's Tern
GBH	Great Blue Heron
GBT	Gull-billed Tern
GE	Great Egret
LB	Least Bittern
LBH	Little Blue Heron
LG	Laughing Gull
LH	Louisiana Heron
LT	Least Tern
OC	Olivaceous Cormorant
RE	Reddish Egret
RS	Roseate Spoonbill
RT	Royal Tern
SE	Snowy Egret
SaT	Sandwich Tern
SoT	Sooty Tern
T?	Tern (Species unknown)
WI	White Ibis
WGI	White-faced Ibis
WoI	Wood Ibis
WP	White Pelican
YCNH	Yellow-crowned Night Heron
*	Loafing, not nesting
?	Unknown number of birds present

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
1.	Sidney Island	29°58'35"	93°49'35"	OC LBH CE GE SE LH BCNH WGI WI RS	150 3 1100 500 250 200 2 100 100 400			
2.	Rollover Bay Island	29°30'50"	94°30'10"	BS FT	125 250	oyster shell, clay	bare, sparse shrubs	natural island
3.	Surprise Lake	29°33'40"	94°40'40"	RS*	50			inland colony
4.	Hanna's Reef	29°29'40"	94°47'10"	LT BS	no nests	oyster shell,	bare	natural reef
5.	Little Vingt-et-un Island	29°33'30"	94°46'30"	GBH OC RS	10 90 30	oyster shell, clay	bare, shrubs, trees	natural island
6.	Vingt-et-un Island	29°35'30"	94°46'30"	RS GBH GE C?	5 50 200 30	as above	as above	as above
7.	Trinity River Channel Island #3	29°35'00"	94°44'05"	RS E?	60 100	as above	as above	dredged material island
8.	Trinity River Channel Island #4	29°35'00"	94°44'10"	BS	100	as above	bare, shrubs	as above
9.	Cross Bayou Island	29°45'55"	94°46'40"	BS	300	as above	as above	as above
10.	Cedar Bayou Island	29°40'38"	94°55'50"					no nesting in 1976
11.	Baytown Tunnel Colony	29°42'20"	95°00'30"	GE RS	10 15	sandy clay	medium shrubs	island colony in lake
12.	Atkinson Island (South)	29°41'06"	94°57'48"	BS	175	oyster shell, clay	sparse shrubs, bare	dredged material island
13.	Atkinson Island (North)	29°40'42"	94°57'40"	CE GE SE LH LBH	1750 15 375 20 8	as above	*Spartina* spp., bare, trees, shrubs, fresh-water	as above

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
13.	Atkinson Island (North) (con't)			GBH	1			
				BCNH	100			
				RS	275			
				WoI	1			
14.	Redfish Island	29°31'00"	94°53'00"	GBH	120	oyster shell, clay	complex, bare shrubs, trees	natural reef island with some dredged material added to west side
				CE	1520			
				GE	250			
				SE	750			
				LH	30			
				BCNH	5			
				RS	50			
15.	Smith Point Island	29°32'18"	94°47'25"	BS	100	oyster shell, sand, clay	grass, shrubs, trees, bare	natural island with dredged material added
16.	Little Pelican Island	29°21'00"	94°49'30"	GBH	20	clay, sand, oyster shell	grass, shrubs, few trees	natural island, diked with large dredged material deposits
				CE	65			
				RE	4			
				GE	24			
				SE	9			
				LH	15			
				BCNH	86			
				WGI	14			
				WI	1			
				RS	43			
				LG	3750			
17.	Moses Lake Islands	29°25'40"	94°56'12"	FT	178	sand, cobble, shell	grass, bare, low shrubs	series of dredged material islands in a lake
				BS	24			
18.	Swan Lake	29°21'00"	94°54'00"	BCNH	4	mud, sand	medium height shrubs, bare	salt marsh
				GBH	20			
				GE	105			
				SE	25			
				RS	14			
				WI	5			
				LH	1			
				FT	88			
19.	Tiki Island (Wilson's Point)	29°18'00"	94°55'00"	LT	28	sand, shell, clay, cobble	herbaceous, bare	maze of channels - housing development
				BS	38			
20.	West Bay Buoy #52	29°17'50"	94°55'30"	LBH	3	clay, sand	dense shrubs, brush, *Prosopis* spp.	dredged materail island
				GBH	1			
				SE	16			
				LH	3			

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bire Species	No. Pairs	Substrate	Vegetation	Remarks
20.	West Bay Buoy #52 Island (con't)			BCNH	6			
				WI	3			
				RE	2			
21.	North Deer Island	29°17'20"	94°55'30"	GBH	75	clay, sand	dense shrubs, trees, *Spartina* spp.	natural island with dredged material deposition behind dikes
				CE	75			
				RE	5			
				GE	150			
				SE	450			
				LH	present			
				BCNH	75			
				WGI	400			
				WI	6			
				RS	50			
				LG	6000			
				AO	1			
				T?	1500			
22.	Down North Deer Island (West Bay Island #43)	29°17'00"	94°55'00"	GBH	5	clay, oyster bar on west end	dense shrubs, *Spartina* spp. marsh	dredged material island
				RE	5			
				RS	150			
				WI	100			
				E?	many			
23.	South Deer Island	29°16'00"	94°54'00"	LH	3	clay, sand	dense low shrubs, extensive marsh	natural island
				WGI	18			
				CaT	25			
				BS	15			
				LG	1000			
				LBH	3			
				WI	6			
				RE	1			
				SE	3			
24.	Gangs Bayou Point	29°15'10"	94°55'50"	AO	1	as above	sparse, salt marsh	northwest projection of Galveston Island into West Bay
				BS	past			
				CaT	past			
				FT	past			
25.	Oxen Bayou Point	29°14'08"	94°55'48"	FT	3	as above	as above	as above
26.	Mensell Bayou Point	29°14'18"	94°56'45"	FT	60	as above	as above	as above
27.	Starvation Point	29°14'05"	94°56'45"	FT	75	as above	as above	as above
28.	Hoecker's Point	29°13'48"	94°57'06"	FT	?	as above	as above	as above

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
29.	Little Snake Island	29°09'45"	95°02'18"	LG	20	clay	sparse, salt marsh	small natural island NE of Snake Island
				T?	100			
30.	Snake Island	29°09'40"	95°02'36"	BS	125	oyster shell, clay, sand	bare, grass low shrubs, salt marsh	natural island
				LG	99			
				LH	5			
31.	Bay Harbor Bar	29°08'12"	95°04'42"	BS	125	oyster shell, clay	sparse	natural reef
32.	Bird Island	29°05'44"	95°08'30"	FT	50	clay, sand	low shrubs, bare beach grass, salt marsh	natural island
				LH	3			
				LB	1			
				LG	20			
				GBH	15			
				RE	2			
				SE	5			
				WI	1			
				GE	3			
33.	Treasure Island (San Luis Island)	29°04'00"	95°08'00"	LT	1	clay	sparse, low	part of mainland south of San Luis Pass
				BS	2			
34.	San Luis Pass	29°06'00"	95°07'00"	BS	50	sand, cobble shell	low shrubs, sparse, bare	salt marsh area
				LT	5			
				BCNH	5			
35.	Follet's Island	29°02'30"	95°10'30"	LT	?	sand, clay, shell	sparse, bare grass	north end of Matagorda Island at San Luis Pass
				BS	?			
36.	Dressing Point Island	28°43'50"	95°45'35"	GBH	125	clay, sand, oyster shell	complex, bare, shrubs, trees	natural island
				LBH	2			
				CE	1000			
				RE	64			
				GE	200			
				SE	125			
				LH	600			
				BCNH	10			
				WGI	200			
				WI	150			
				RS	36			
				FT	25			
				SaT	125			
				BS	75			
				LG	1000			

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
37.	Sundown Island	28°28'40"	96°23'05"	GBH	75	clay	complex, bare, shrubs, trees	dredged material island
				CE	250			
				RE	68			
				GE	50			
				SE	100			
				LH	1250			
				WGI	600			
				RS	20			
				GBT	3			
				RT	2000			
				SaT	750			
				LG	1250			
38.	Matagorda Bay Dredged Islands (8)	28°30'- 28°32'00"	96°20'- 96°30'00"	GBH	63	clay, sand	comples, shrubs, bare	dredged material islands along Matagorda channel
				RE	36			
				GE	200			
				SE	150			
				CE	2050			
				LH	800			
				BCNH	25			
				RS	20			
				LG	10			
				BS	46			
				LBH	12			
				WI	300			
				LT	25			
39.	Lavaca Bay Dredged Islands (9)	28°36'00"	96°34'00"	CE	1400	as above	as above	dredged material islands along Matagorda channel in Lavaca Bay
				RE	1			
				GE	200			
				SE	113			
				LH	286			
				BCNH	20			
				WGI	250			
				WI	36			
				FT	30			
				LT	5			
				CaT	99			
				BS	46			
				GBH	85			
				LBH	8			
				RS	70			

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
40.	Big Steamboat Island	28°18'35"	96°37'15"	GBH	125	clay, sand	complex, shrubs	natural island
				GE	75			
				RS	10			
				BS	25			
				LG	20			
41.	Little Steamboat Island	28°18'15"	96°37'26"	wading birds	?	as above	as above	as above
42.	Turnstake Island	28°18'52"	96°40'53"	GBH	10	as above	shrubs, grass	dredged material island
				BS	10			
				LG	20			
				LH	20			
43.	Seadrift Dredged Islands	28°33'35"	96°44'20"	GBH	70	as above	bare, grass, shrubs	as above
				GE	40			
				SE	125			
				LH	10			
				RS	65			
				CaT	30			
				BS	75			
44.	Guadalupe River Delta	28°25'00"	96°47'00"	wading birds	?	clay, sand, mud	marsh grasses	delta marsh at mouth of Guadalupe River
45.	Panther Point	28°12'50"	96°42'00"	BS	?	clay, sand	marsh	projection of Matagorda Island into San Antonio Bay
46.	False Live Oak Point (2 islands)	28°14'12"	96°46'45"	GBH	1	as above	sparse, shrubs	dredged material island
				GBT	2			
				FT	5			
				BS	90			
47.	Second Chain of Islands	28°11'20"	96°48'55"	BP	6	as above	complex, mostly shrubs	several natural islands at junction of Ayres and San Antonio Bays
				GBH	366			
				CE	20			
				RE	56			
				GE	810			
				SE	400			
				LH	100			
				BCNH	100			
				RS	130			
				GBT	52			
				CaT	56			
				FT	120			
				[illegible]	186			
				[illegible]	[illegible]			

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
48.	Third Chain of Islands	28°08'15"	96°52'26"	GBT LT BS	64 50 420	clay, sand	sparse, shrubs, grass	several small natural islands between Mesquite and Carlos Bays
49.	Long Reef Island	28°04'12"	96°58'06"	GBH RE GE SE LH LG RT ST	5 65 2 1 7 100 50 60	as above	shrubs	natural island
50.	Deadman Island	28°03'52"	96°57'45"	GBH RE LG CaT RT ST BS	6 88 100 126 150 750 42	clay, shell, sand	herbs, shrubs, trees	as above
51.	Little Bay Islands	28°02'00"	97°02'22"	GBH GBT LT BS	35 65 60 155	clay	shrubs	natural inland islands
52.	Redfish Bay #3 (2 islands)	27°56'00"	97°05'00"	GBH RE GE SE LH LG FT BS	13 54 1 3 47 320 25 50	clay, sand	shrubs, low trees	2 dredged material islands near Big Bayou in Redfish Bay
53.	Abandoned Causeway Islands (RB2)	27°55'00"	97°56'10"	GBH RE LH LG	7 1 7 430	as above	herbs, shrubs	dredged material islands across Redfish Bay
54.	Redfish Bay Islands #1	27°55'40"	97°05'50"	GBH LH LG CaT BS	2 1 55 60 30	clay, shell, sand	low shrubs	series of dredged material islands E of ICWW marker 27 in Redfish Bay

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
55.	Grass Island	27°53'50"	97°05'45"	GBH	95	clay	shrubs, herbs	natural island
56.	Hog Island	27°54'00"	97°06'15"	GBH	110	clay, sand	dense shrubs	as above
				GE	80			
				SE	35			
				LH	15			
				BCNH	115			
				RS	75			
				CE	100			
				WGI	2			
				LG	100			
57.	Danger Island	27°54'32"	97°07'28"	GBH	80	clay, sand, shell	dense shrubs, low trees, bare areas	dredged material island
				LBH	1			
				RE	25			
				GE	50			
				SE	310			
				LG	3000			
				CE	800			
				LH	1000			
				BCNH	20			
				LB	1			
				WGI	500			
58.	Aransas Channel Islands #1 (3 islands)	27°53'45"	97°07'19"	FT	90	clay, sand, shell	complex shrubs and herbs	small dredged material islands
				GBT	4			
				LG	10			
				BS	42			
59.	Aransas Channel Islands #2 (5 islands)	27°53'50"	97°07'02"	GBH	2	clay	sparse shrubs	as above
				RE	4			
				LH	46			
				WGI	2			
				LG	770			
				GBT	2			
				FT	40			
				CaT	50			
				BS	100			
60.	Aransas Channel Island #3	27°53'58"	97°06'22"	LH	10	as above	as above	small dredged material island
				LG	300			
				GBT	2			
				BS	100			
61.	Harbor Island	27°53'00"	97°04'00"	LB	20+	clay, shell, sand	shrubs, *Avicennia germinans*	large natural island
				LT	15+			

No.	Island	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
[illegible]	[illegible]	[illegible]	97°08'00"	no survey for 1976		clay, shell	shrubs, *Tamarix* spp.	natural island with dredged material on south end
[illegible]	[illegible] Point Island	27°51'05"	97°08'20"	as above		as above	shrubs, trees	natural island
[illegible]	[illegible] Island	27°50'08"	97°10'14"	as above		as above	as above	as above
[illegible]	[illegible] Island	27°49'15"	97°08'57"	BP	6	clay, shell sand	bare, low trees, complex shrubs	large dredged material island
				GBH	250			
				CE	40			
				RE	70			
				GE	52			
				SE	75			
				LH	220			
				BCNH	100			
				WGI	250			
				RS	35			
				FT	?			
				LT	?			
				RT	2000			
				SaT	1000			
				CaT	20			
				BS	150			
				LG	2000			
66.	Shamrock Island	27°46'00"	97°10'00"	GBH	28	as above	complex vegetation, shrubs, trees and bare shell and sand	natural island
				RE	4			
				GE	12			
				SE	24			
				CE	94			
				RS	86			
				BCNH	28			
				LG	725			
				SoT	2			
				BS	44			
67.	Island E of Laguna Madre ICWW marker 7A	27°40'08"	97°12'38"	GBH	21	clay	shrubs, low trees, cactus	natural island
				CE	14			
				BCNH	20			
				LT	1			
68.	Kennedy Causeway Islands #1 (2 islands)	27°39'40"	97°15'35"	GBH	6	as above	low shrubs	dredged material islands along private (oil) channel

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
69.	Kennedy Causeway Islands #2 (2 islands)	27°39'45"	97°19'31"	LG	10	clay	low shrubs	dredged material islands along private (oil) channel
70.	Kennedy Causeway Islands #3 (3 islands)	27°39'46"	97°19'15"	GBH RE LG	8 1 20	as above	as above	as above
71.	Kennedy Causeway Islands #4 (4 islands)	27°40'00"	97°19'30"	wading birds	?	as above	as above	as above
72.	Kennedy Causeway Islands #5 (5 islands)	27°39'48"	97°18'53"	GBH BS	10 50	as above	as above	as above
73.	Kennedy Causeway Islands #6 (8 islands)	27°40'20"	97°19'00"	GBH RE LH LG	9 1 2 11	clay, shell	as above	dredged material islands along sea plane channel
74.	Kennedy Causeway Islands #6b (2 islands)	27°40'14"	97°19'26"	GBH	2	clay	as above	small dredged material island along private (oil) channel
75.	Kennedy Causeway Island #7	27°40'44"	97°18'32"	BCNH AA LT LG GBH CE RE GE LH	34 3 1 4 57 12 1 8 4	clay, shell	as above	large island from dredged material of sea plane channel
76.	Kennedy Causeway Island #8	27°41'11"	97°18'10"	GBH RE LH WGI LT LG BS	8 3 5 30 20 300 130	as above	low shrubs, few trees, bare oyster shell beaches	island formed from dredged material of sea plane channel
77.	Kennedy Causeway Island #9	27°40'55"	97°14'06"	wading birds	?	as above	sparse vegetation	natural island or partly submerged bar
78.	Kennedy Causeway #10	27°41'05"	97°13'40"	as above		as above	as above	as above
79.	Kennedy Causeway Islands #11 (4 islands)	27°39'11"	97°18'30"	GBH RE SE	10 24 2	as above	low shrubs	dredged material islands from private (oil) channel

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
79.	Kennedy Causeway Islands #11 (continued)			LH LG	12 150			
80.	Kennedy Causeway Islands #12 (4 islands)	27°39'25"	97°18'42"	GBH RE BS LG	4 1 10 10	clay, shell	sparse vegetation	natural island or partly submerged bar
81.	Kennedy Causeway Island #13	27°19'01"	97°19'01"	GBH RE BCNH LG	2 1 1 4	as above	as above	as above
82.	Kennedy Causeway Islands #14 (2 islands)	27°39'40"	97°19'01"	GBH LG	1 20	as above	low dense shrubs	as above
83.	Laguna Madre ICWW buoy 3A	27°39'57"	97°13'18"	GBH GE LH	8 1 1	as above	shrubs, cactus, *Prosopis* spp.	dredged material island from construction of ICWW
84.	Laguna Madre 3A.5	27°40'02"	97°13'21"	wading birds	?	as above	low shrubs	as above
85.	Laguna Madre 5	27°40'03"	97°13'24"	as above		clay, shell, sand	as above	as above
86.	Laguna Madre 5A	27°40'12"	97°13'27"	as above		as above	as above	as above
87.	Laguna Madre 7	27°39'53"	97°13'30"	as above		as above	as above	as above
88.	Laguna Madre 7A	27°39'50"	97°13'33"	as above		as above	as above	as above
89.	Laguna Madre 9	27°39'46"	97°13'36"	as above		as above	as above	as above
90.	Laguna Madre 9A	27°39'42"	97°13'30"	as above		as above	as above	as above
91.	Laguna Madre 9A.5	27°39'30"	97°13'39"	as above		clay, sand	as above	as above
92.	Laguna Madre 11	27°39'25"	97°13'41"	as above		as above	low shrubs, cactus, *Prosopis* spp.	as above
93.	Laguna Madre 11A	27°39'20"	97°13'43"	GBH GE	4 2	clay, sand shell	low shrubs, *Prosopis* spp.	as above
94.	Laguna Madre 11A.5	27°39'15"	97°13'45"	wading birds	?	clay, sand	low shrubs	as above
95.	Laguna Madre 13	27°38'50"	97°13'50"	as above		as above	as above	as above
96.	Laguna Madre 13.5	27°38'45"	97°13'55"	GBH GE	6 1	as above	low shrubs, *Prosopis* spp.	as above

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
97.	Laguna Madre 13A	27°38'40"	97°13'55"	GBH CE BCNH BS GBT	31 24 12 33 12	clay, sand, shell	low shrubs, *Prosopis* spp., cactus	dredged material island from construction of ICWW
98.	Laguna Madre 13A.5	27°38'35"	97°13'55"	wading birds	?	clay, sand	low shrubs	as above
99.	Laguna Madre 15	27°38'10"	97°14'08"	GBH CE GE BCNH BS	25 75 12 10 20	clay, sand, shell	shrubs, cactus *Prosopis* spp., *Tamarix* spp.	as above
100.	Causeway Channel Islands	27°39'00"	97°16'00"	LG BS RE FT GBH LH SE LT GBT RT CaT SaT WGI	4584 80 4 92 26 76 30 20 4 400 50 20 28	clay, shell	low, dense shrubs, few low *Prosopis* spp.	series of islands of dredged material from private (oil) channel along causeway
101.	Humble Channel Island #1	27°35'50"	97°16'35"	wading birds	?	clay, shell, sand	low shrubs	dredged material island W of Laguna Madre ICWW marker 29
102.	Humble Channel Island #2	27°35'45"	97°16'22"	GBH RE SE LH	1 5 3 10	as above	as above	as above
103.	Humble Channel Island #3	27°35'40"	97°16'20"	GBH LH LG SE	1 7 375 3	as above	as above	as above
104.	Humble Channel Island #4	27°35'42"	97°16'10"	GBH GE SE LG	1 2 14 500	as above	as above	as above

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
105.	Humble Channel Island #5	27°35'35"	97°16'01"	wading birds	?	clay	low shrubs	dredged material island W of Laguna Madre ICWW marker 29
106.	North Bird Island	27°30'45"	97°17'33"	GBH	25	clay, sand	grass, low shrubs	natural island
107.	Laguna Madre 43	27°32'00"	97°16'55"	LG GBT BS	1 12 128	clay, sand, shell	low shrubs	dredged material island from construction of ICWW
108.	Laguna Madre 47	27°31'17"	97°17'43"	BS	18	as above	as above	as above
109.	Laguna Madre 47A	27°31'00"	97°17'54"	BS	18	as above	grass, shrubs	as above
110.	Laguna Madre 49A	27°31'36"	97°18'02"	BS GBT	75 3	as above	as above	as above
111.	South Bird Island	27°29'32"	97°18'22"	WP GBH CE RE SE LH WGI RS RT LG SaT	250 96 170 210 40 85 250 95 550 6000 420	clay, sand	complex, shrubs, grass, cactus	large natural island
112.	Laguna Madre 55	27°29'18"	97°18'46"	GBH CE SE BCNH WP	2 420 5 7 35	clay, sand, shell	dense shrubs, cactus, small trees, *Prosopis* spp.	dredged material island from construction of ICWW
113.	Laguna Madre 57	27°28'55"	97°18'00"	GBT CaT BS	52 66 12	as above	low shrubs, *Baccharis* spp., *Nerium Oleander*, *Prosopis* spp.	as above
114.	Laguna Madre 57A	27°28'43"	97°19'15"	WGI LH SE LG GBH CE	142 128 49 5000 8 370	as above	as above, 1 palm, bare areas	as above

APPENDIX A (Continued)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
115.	Laguna Madre 63A	27°27'40"	97°19'38"	BS	45	clay, sand,	shrubs, herbs,	dredged material isalnd
				GBH	1	shell	grasses	from construction of ICWW
116.	Laguna Madre 81	27°23'29"	97°21'46"	WGI	?	as above	shrubs, grasses,	as above
				LG	?		*Baccharis* spp.	
				RS	?			
				LH	?			
				CE	420			
				SE	295			
				GBH	5			
				RE	167			
				GE	8			
				GBT	?			
117.	Laguna Madre 103	27°18'33"	97°24'01"	WGI	16	as above	grass, low	as above
				BS	38		shrubs, herbs	
				GBT	38			
				LG	84			
				LH	17			
				LG	2			
118.	Laguna Madre 105	27°18'22"	97°24'04"	LH	76	as above	as above	as above
				RE	9			
				BS	8			
				GBT	16			
				LG	120			
119	Laguna Madre 107	27°18'10"	97°24'07"	LH	23	as above,	as above,	as above
				RE	16	some rocks	*Nerium O.*	
				GBH	3		*Baccharis* spp.	
				BS	9			
				GBT	8			
				SE	5			
				LG	103			
120.	Laguna Madre 109	27°18'10"	97°24'10"	CE	112	as above	grass, low	as above
				SE	83		shrubs, herbs,	
				RE	29		*Prosopis* spp.	
				LH	68			
				GBT	150			
				LG	95			
				GBH	20			
121.	Laguna Madre 111	27°17'42"	97°24'13"	GBT	18	as above	as above	as above
				LH	13			
				LG	33			
				BS	15			

APPENDIX A (Continued)

Site No.	Name	Latiutde	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
122.	Laguna Madre 113-115	27°17'25"	97°24'16"	GBT BS LG	90 140 90	clay, sand shell	grass, herbs, bare, shrubs	island formed from dredged material of ICWW
123.	Laguna Madre 117	27°17'06"	97°24'18"	BS GBT	23 1	as above	as above	as above
124.	East Laguna Madre 179	27°10'00"	97°24'00"	GBH	30	as above	as above	several dredged material islands along oil company channel
125.	Laguna Madre 169-179	27°10'00"	97°26'00"	LH BS LG T?	10 95 50 30	as above	as above	series of islands formed from dredged material of ICWW
126.	Laguna Madre 227-235	26°47'00"	97°27'00"	nesting birds	?	as above	as above	as above
127.	Mansfield Channel Island #1	26°33'50"	97°24'00"	LH RT SaT BS LG	5 500 1800 45 200	as above	as above	dredged material island near junction of Mansfield Channel and Padre Island
128.	Laguna Madre 281A	26°33'50"	97°24'00"	RE LH SaT BS LG	2 50 30 176 270	as above	as above	island formed from dredged material of ICWW
129.	Laguna Madre 283	26°33'15"	97°24'05"	BS LG	5 5	as above	as above	as above
130.	Laguna Madre 284	26°33'15"	97°24'40"	RT SaT BS LG	12 36 41 28	as above	as above	as above
131.	Laguna Madre 283-301A	26°34'00"	97°24'00"	RE SE LH SaT BS LG RT	5 1 24 1 66 87 50	as above	as above	as above

APPENDIX A (Concluded)

Site No.	Name	Latitude	Longitude	Bird Species	No. Pairs	Substrate	Vegetation	Remarks
132.	Green Island	26°23'32"	97°19'30"	GBH	16	clay, sand, shell	dense, complex vegetation, shrubs, cactus, low trees	natural island E of Laguna Madre 321
				LBH	72			
				CE	26			
				RE	206			
				GE	75			
				SE	98			
				LH	140			
				BCNH	88			
				YCNH	3			
				WGI	36			
				WI	145			
				RS	24			
				LT	15			
				RT	500			
				SaT	1150			
				CaT	17			
				BS	120			
				LG	128			
133.	Laguna Madre 323A-327 and Lower Laguna Madre 1-29	26°18'00" - 26°22'00"	97°15'00"	RE	2	as above	bare, grasses, low shrubs	islands formed from dredged material of ICWW
				LH	2			
				LT	50			
				RT	13			
				SaT	5			
				BS	168			
				LG	70			
134.	Lower Laguna Madre 31-71	26°15'00"	97°17'00"	RE	11	as above	as above	as above
				LH	58			
				RT	1050			
				SaT	396			
				BS	38			
				LG	362			
135.	Lower Laguna Madre 101-123	26°08'00"	97°14'00"	RE	11	as above	as above	as above
				SE	9			
				LH	2			
				RT	80			
				SaT	100			
				BS	59			
				LG	125			
136.	Brownsville Ship Channel Island #1	26°02'42"	97°12'20"	SE	113	as above	low shrubs, herbs	island formed from dredged material of ship channel
				LH	120			
				BS	60			

APPENDIX B: MAPS OF THE TWO STUDY AREAS SHOWING THE LOCATIONS OF THE SERIALLY NUMBERED DREDGED MATERIAL ISLANDS

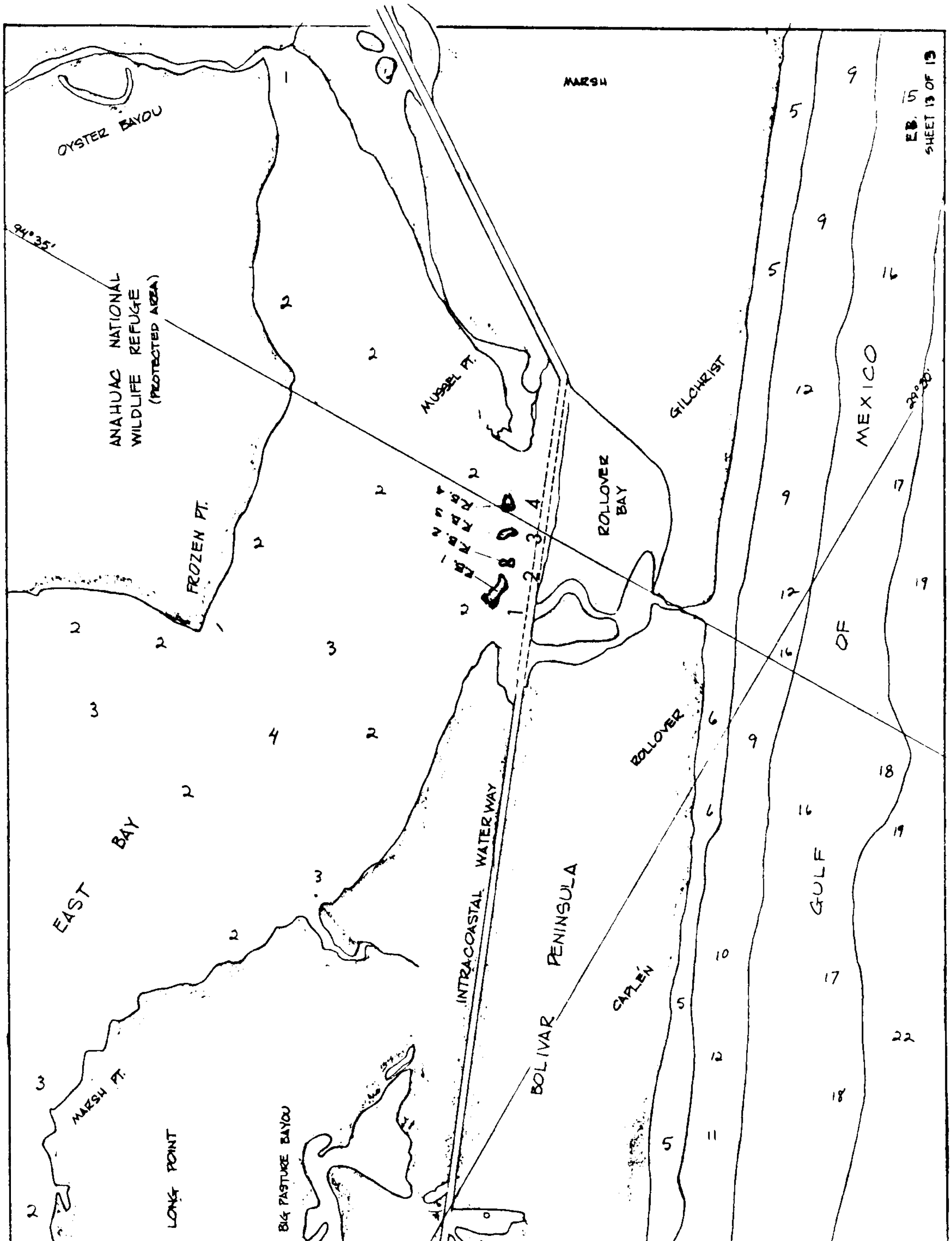

Figure B1. Northern Study Area: Rollover Bay Islands 1-4.

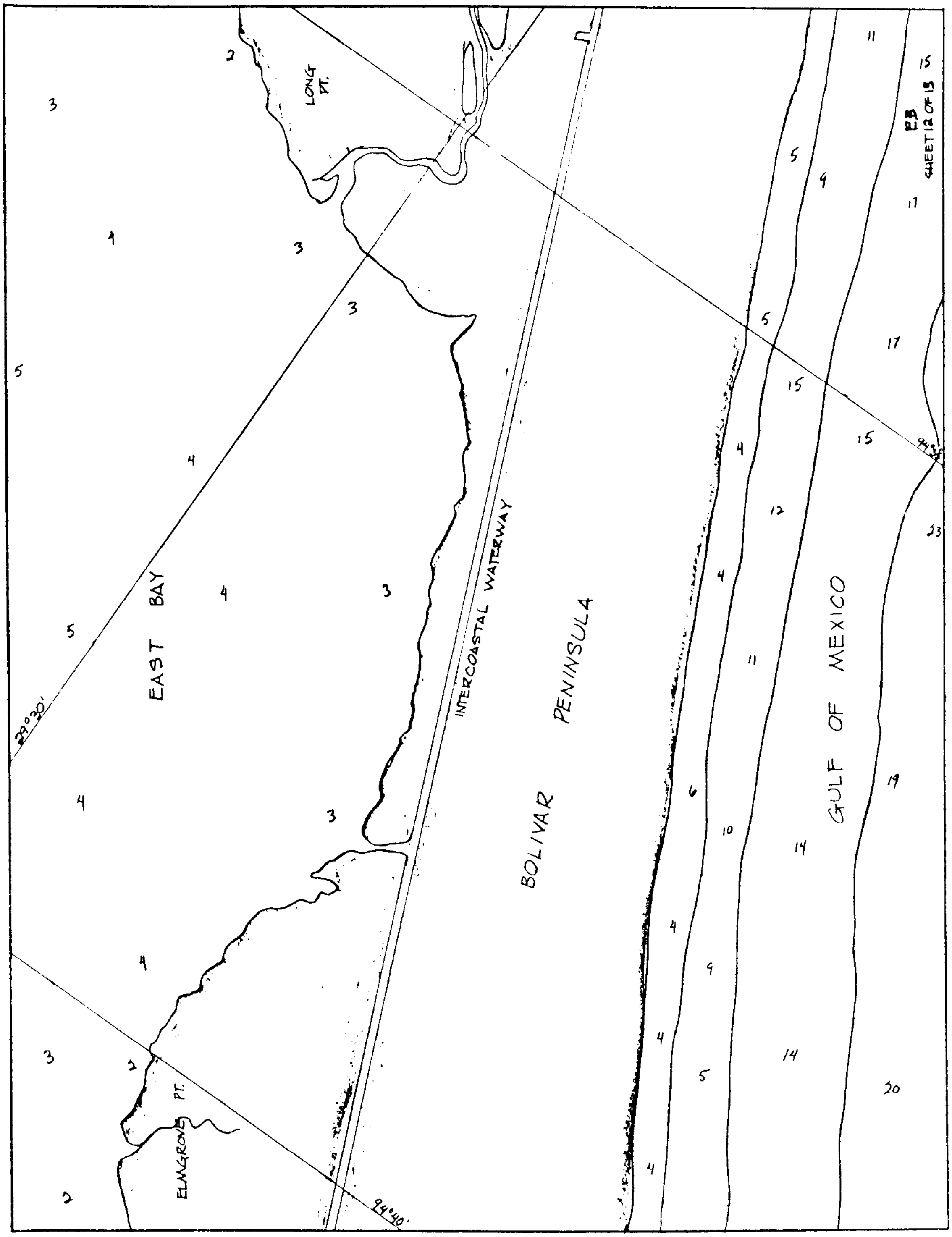

Figure B2. Northern Study Area: East Bay.

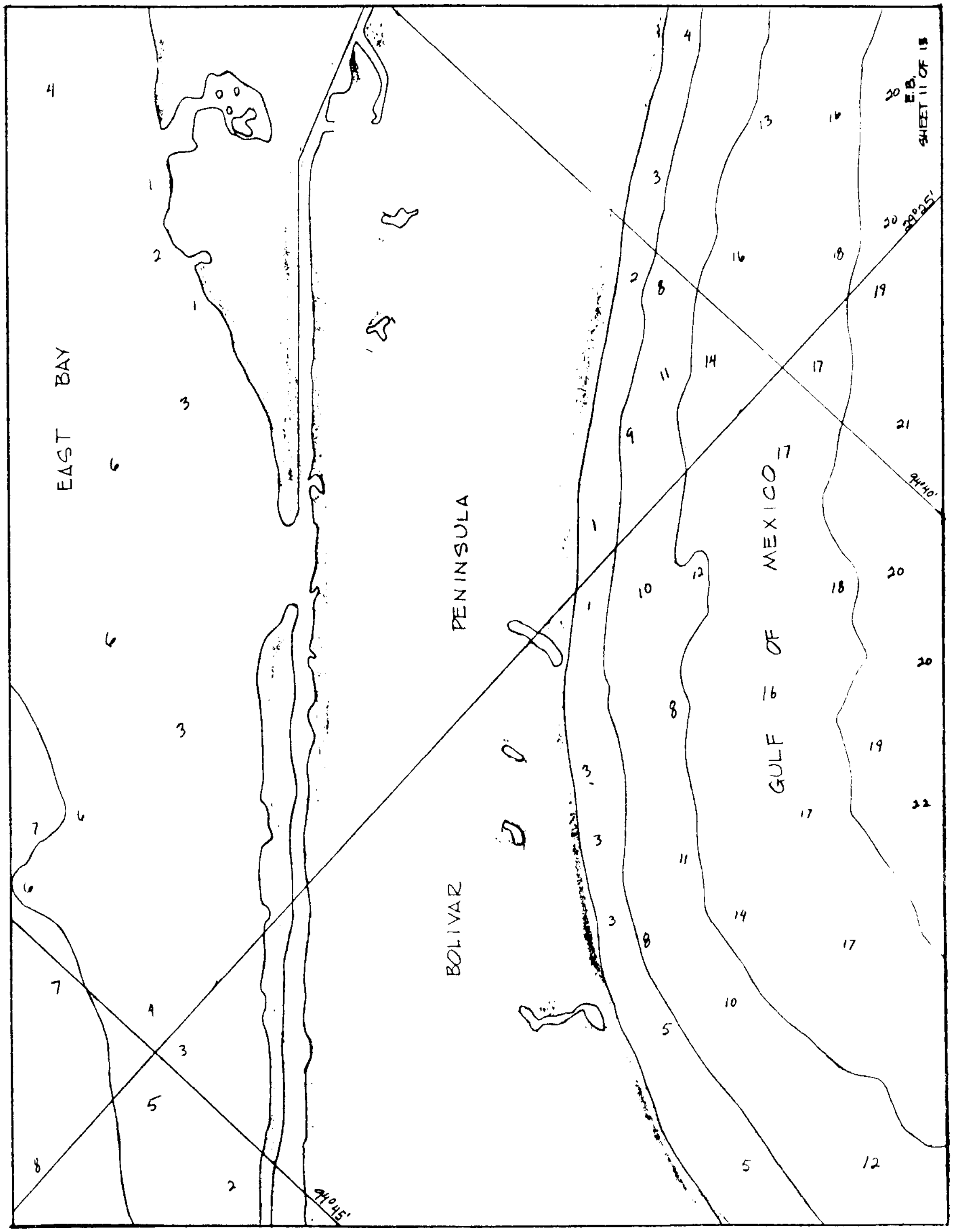

Figure B3. Northern Study Area: East Bay.

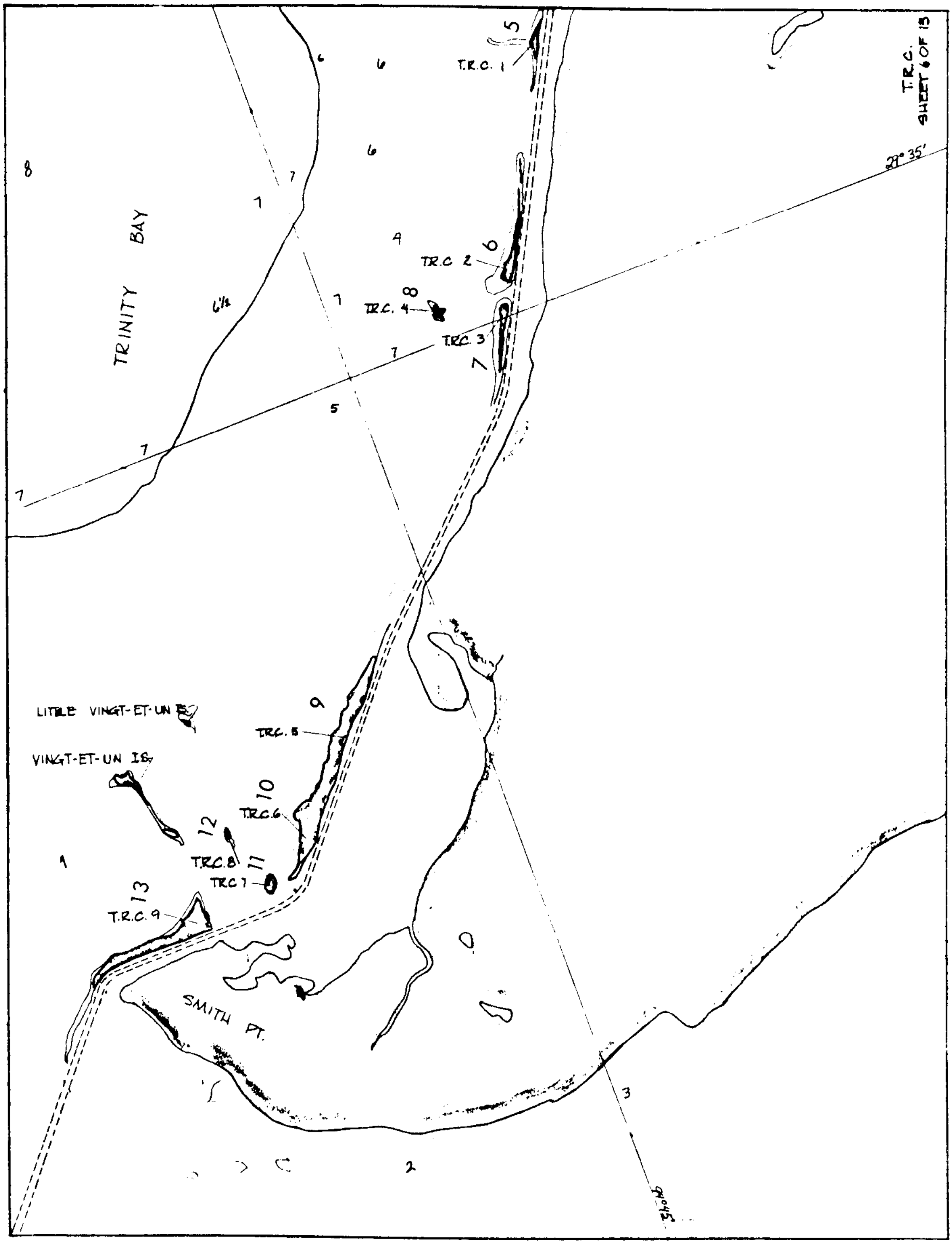

Figure B4. Northern Study Area: Trinity River Channel 5-13.

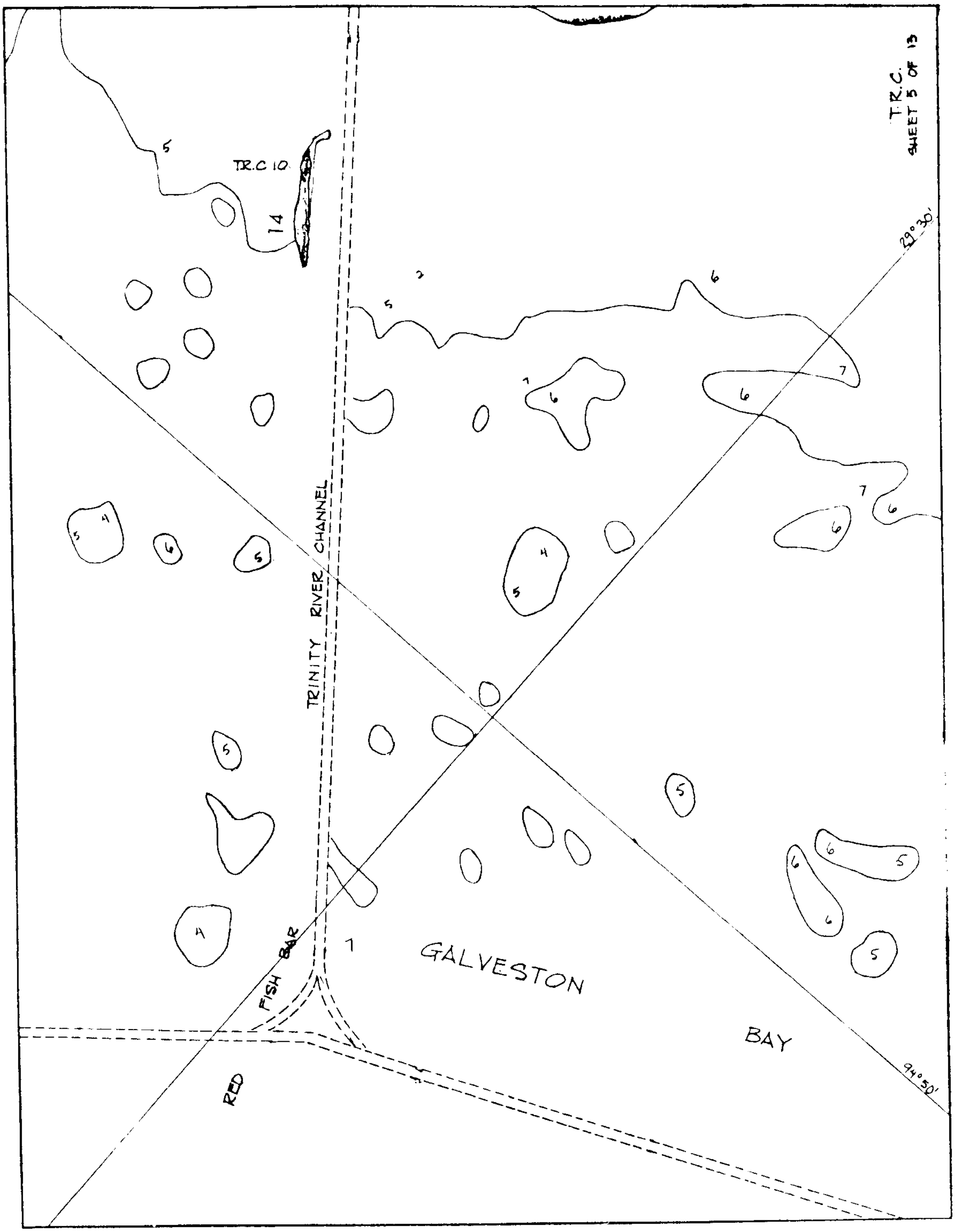

Figure B5. Northern Study Area: Trinity River Channel 14.

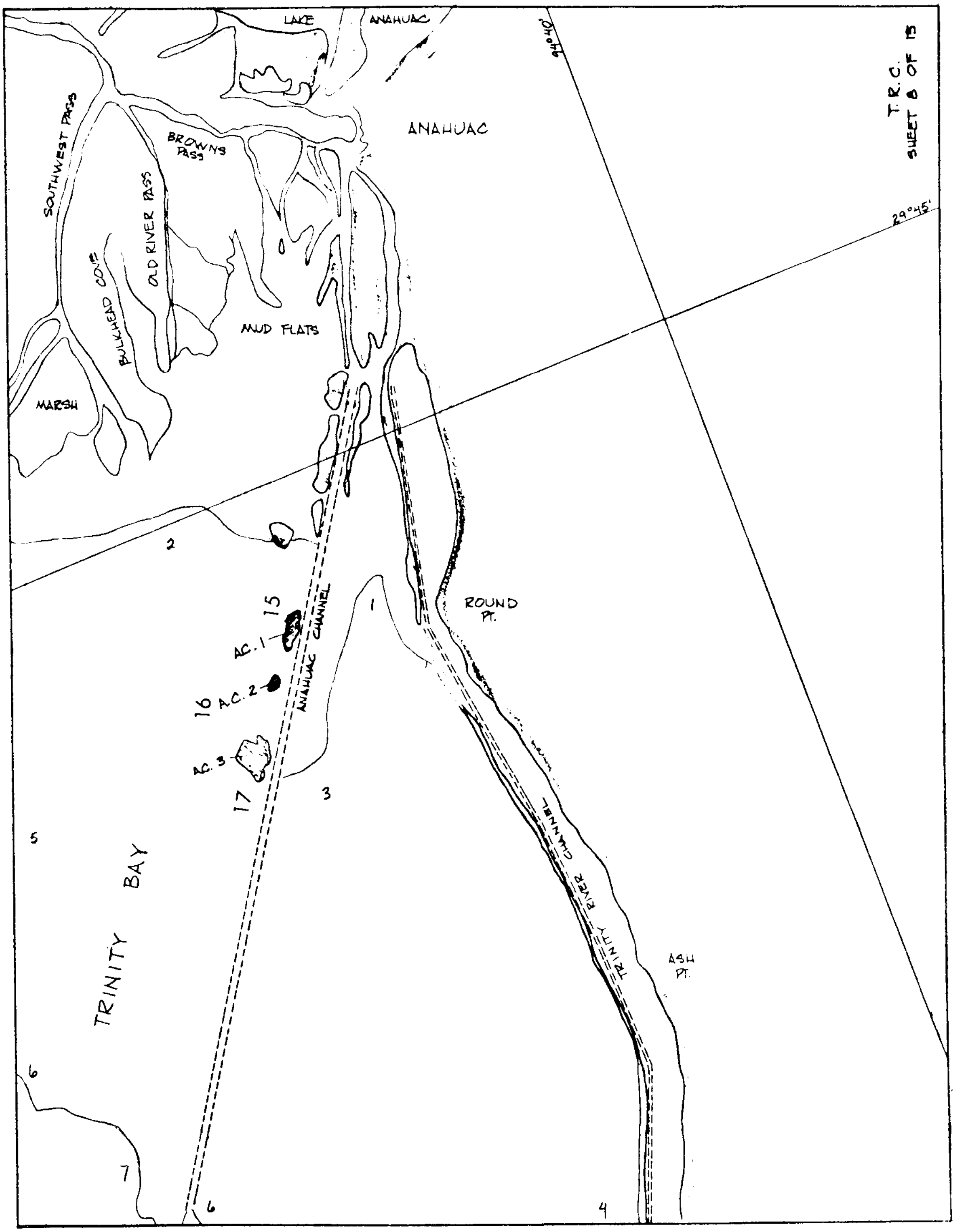

Figure B6. Northern Study Area: Anahuac Channel 15-17.

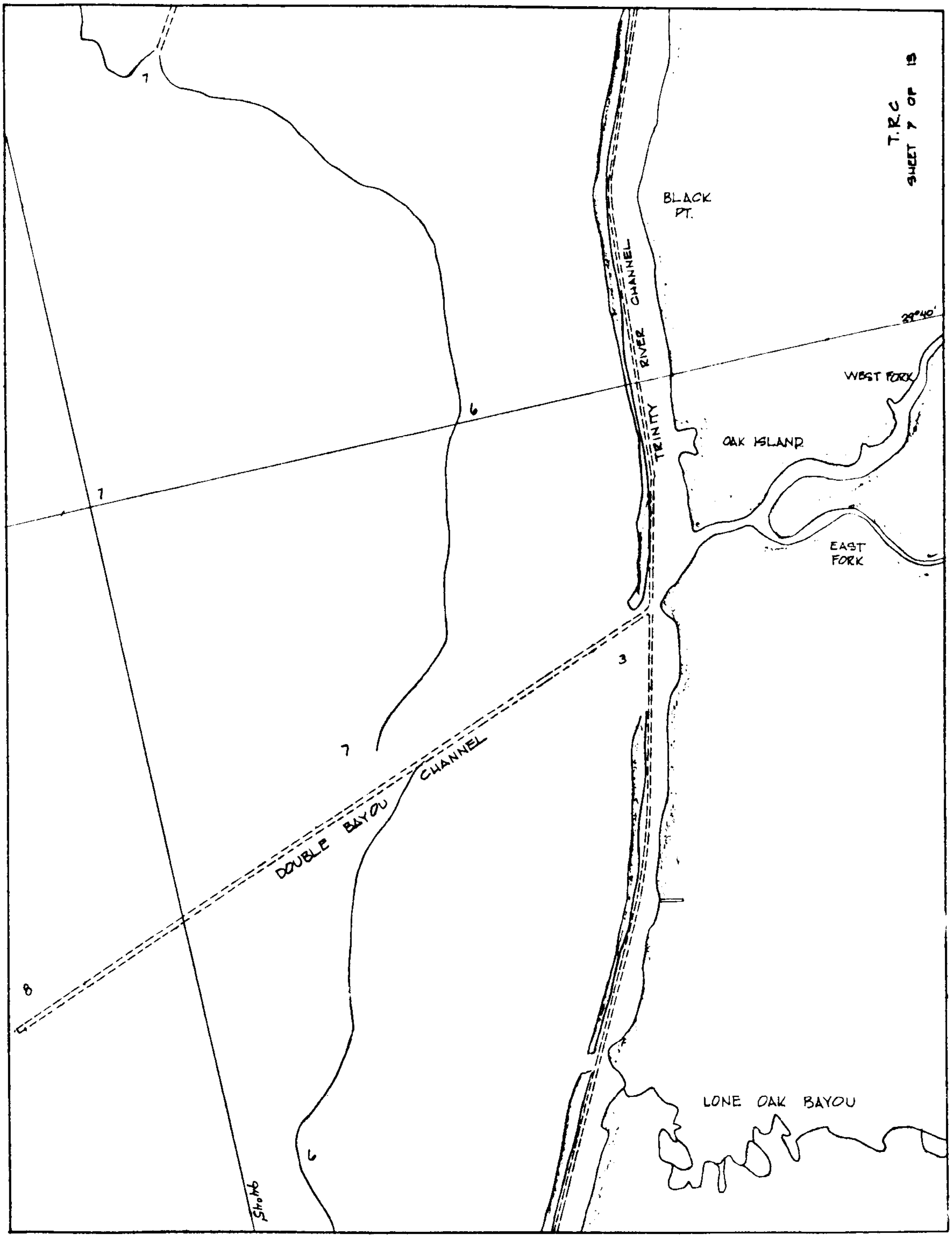

Figure B7. Northern Study Area: Trinity River Channel.

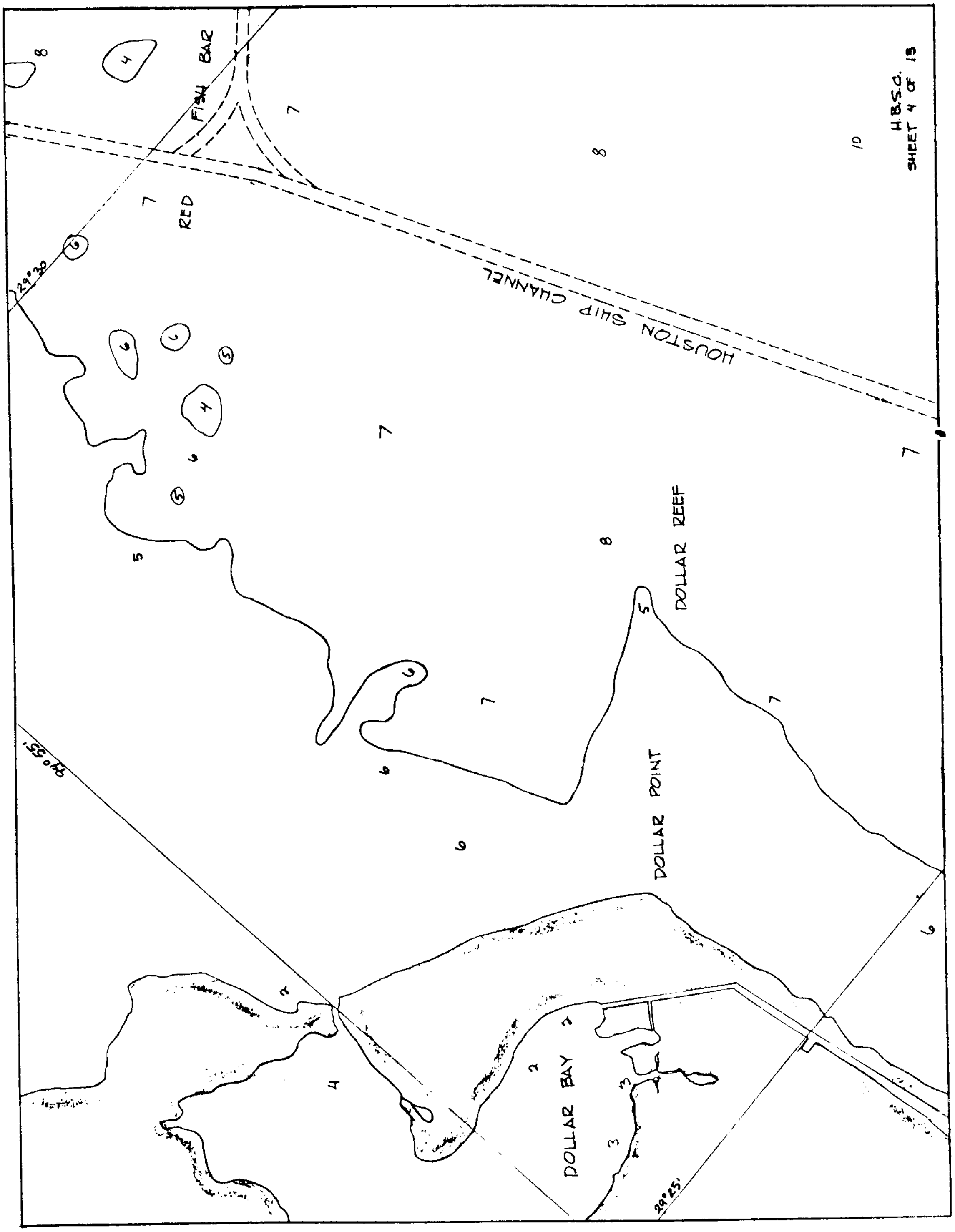

Figure B8. Northern Study Area: Houston Ship Channel.

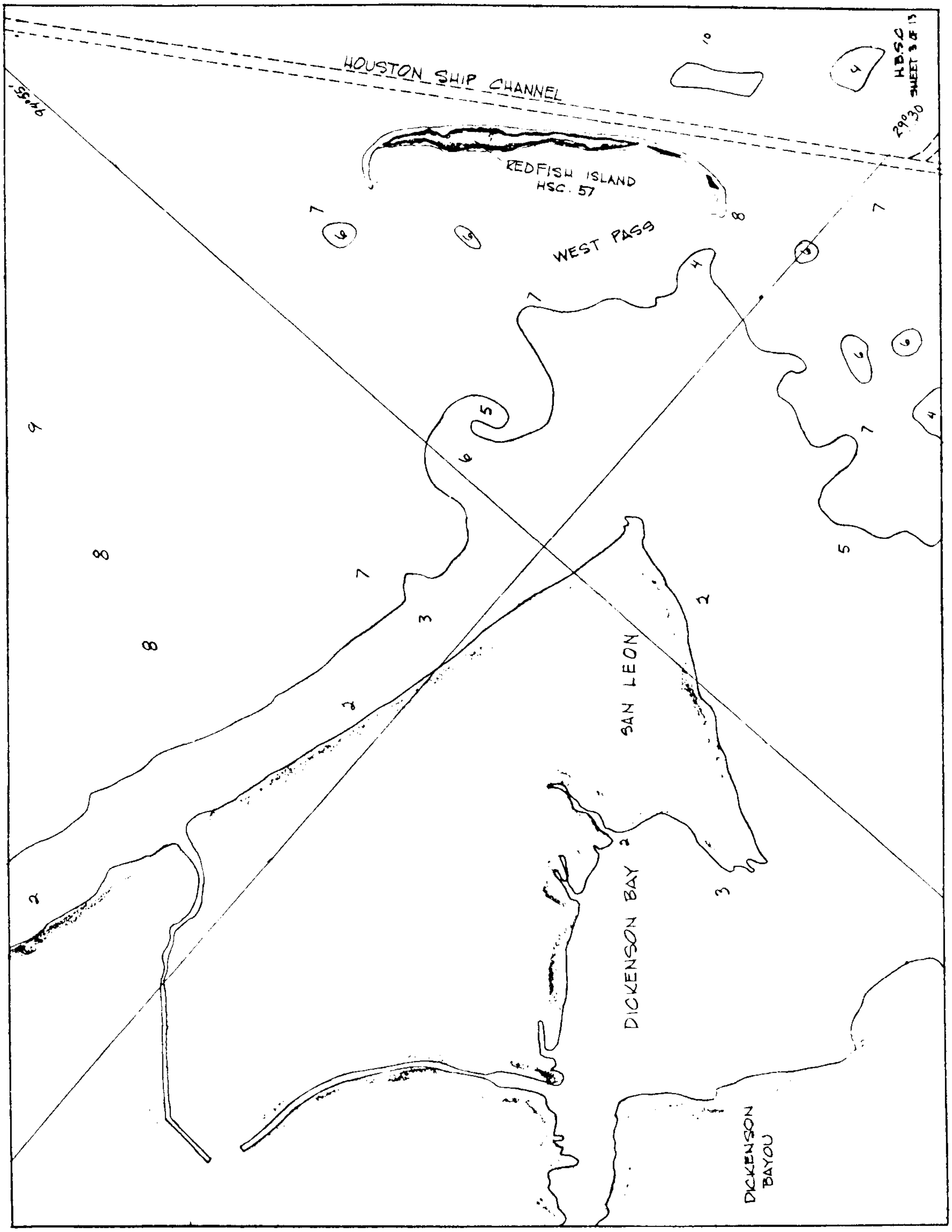

Figure B9. Northern Study Area: Houston Ship Channel.

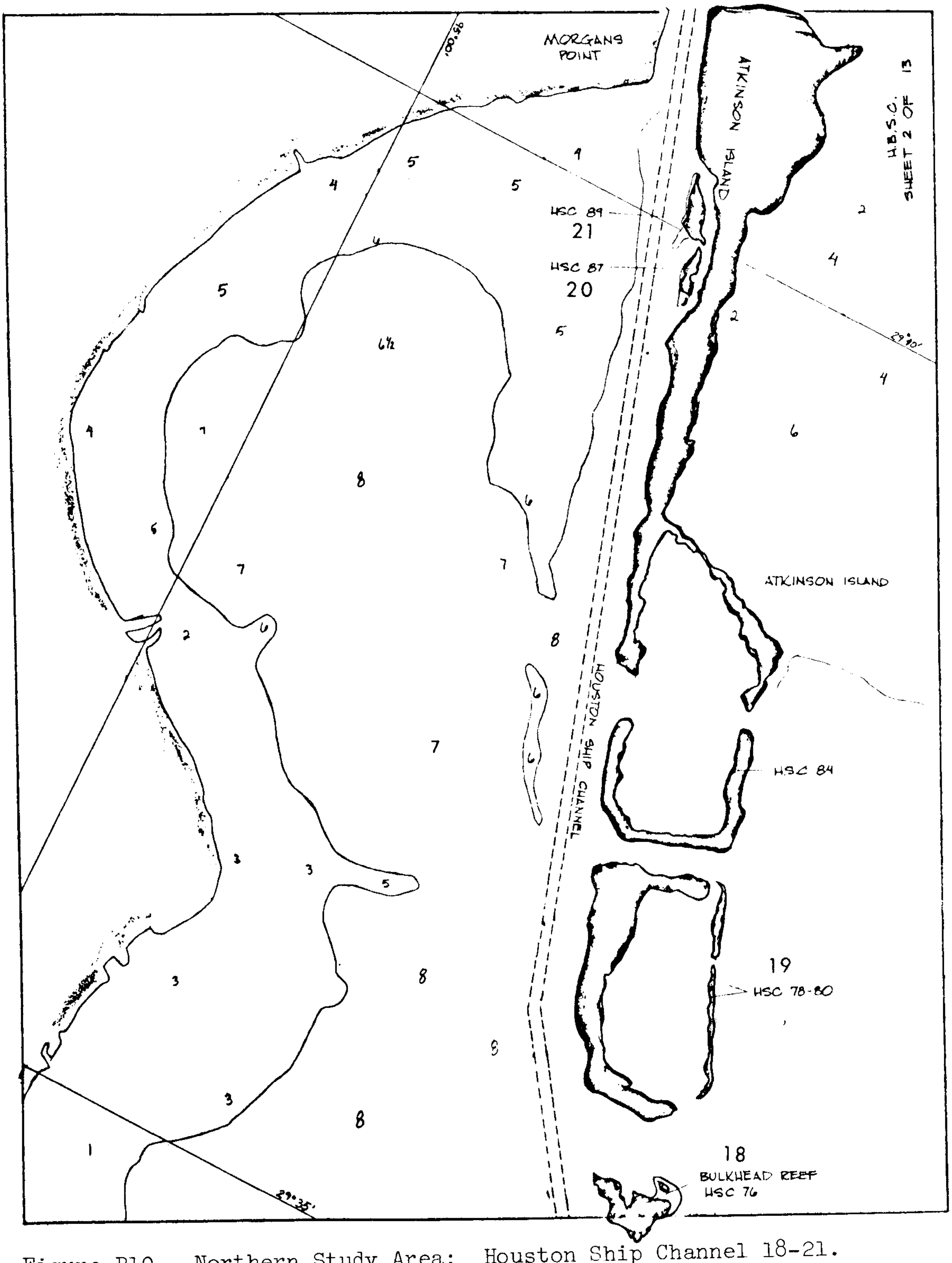

Figure B10. Northern Study Area: Houston Ship Channel 18-21.

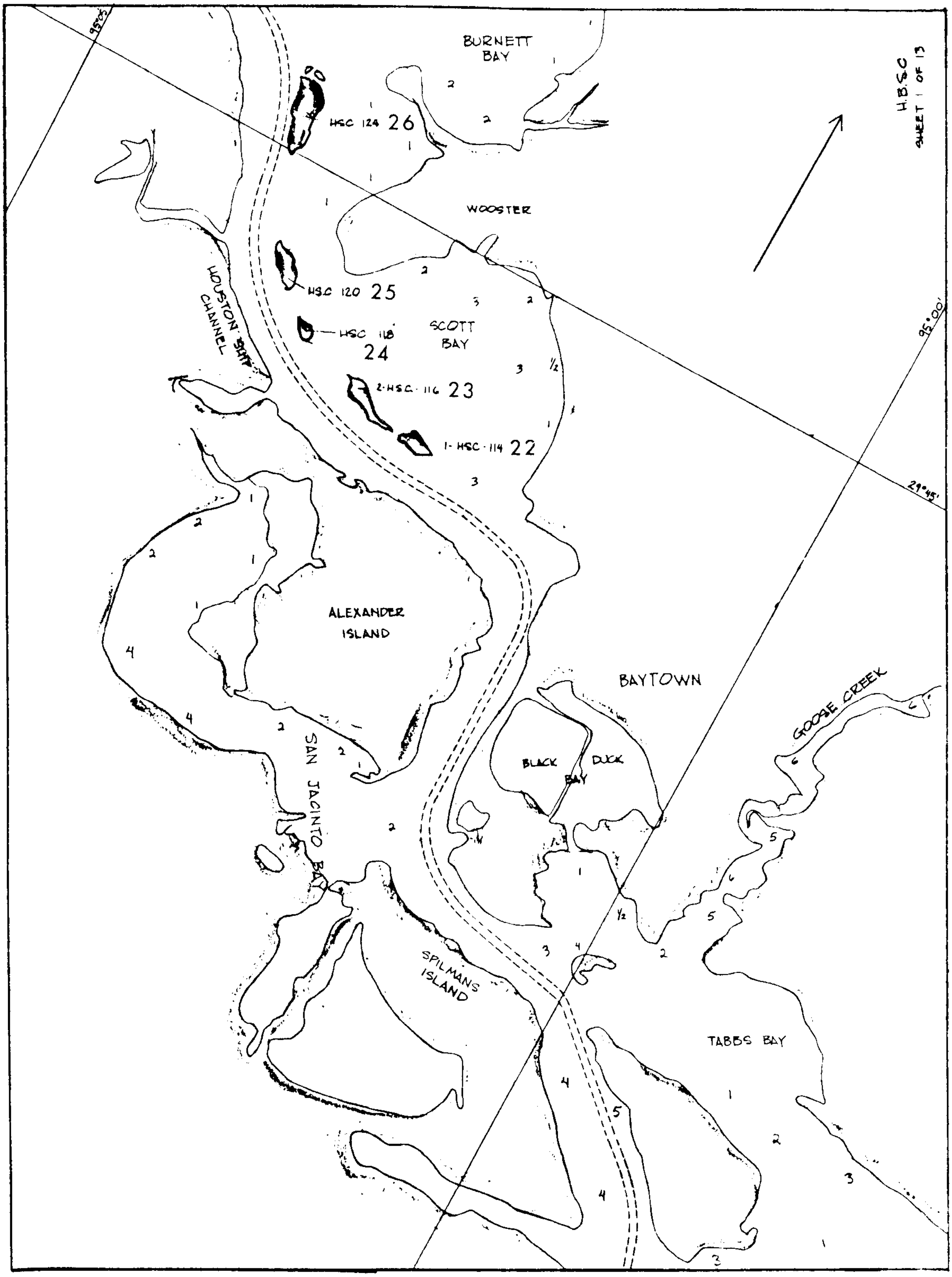

Figure B11. Northern Study Area: Houston Ship Channel 22-26.

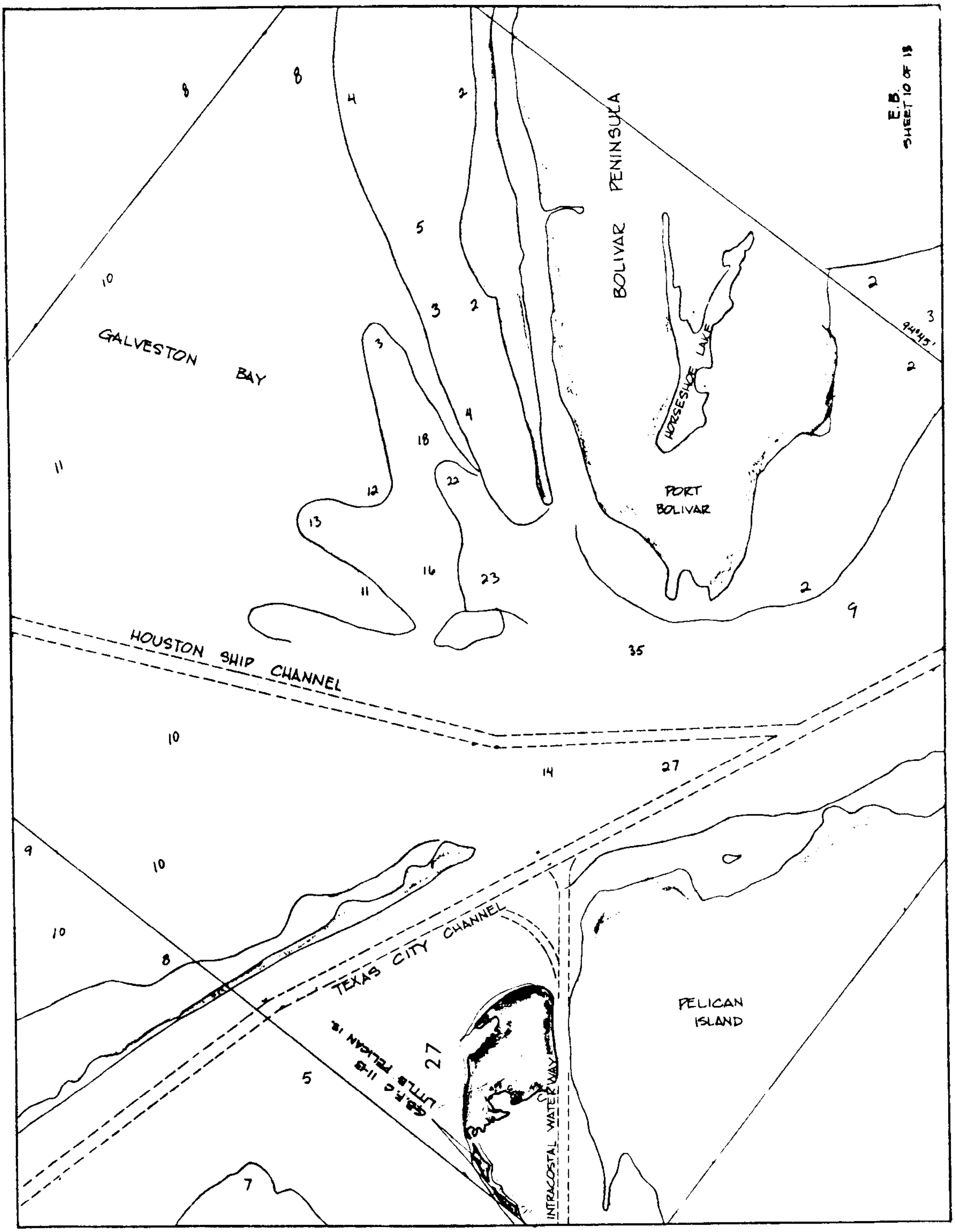

Figure B12. Northern Study Area: Little Pelican Island.

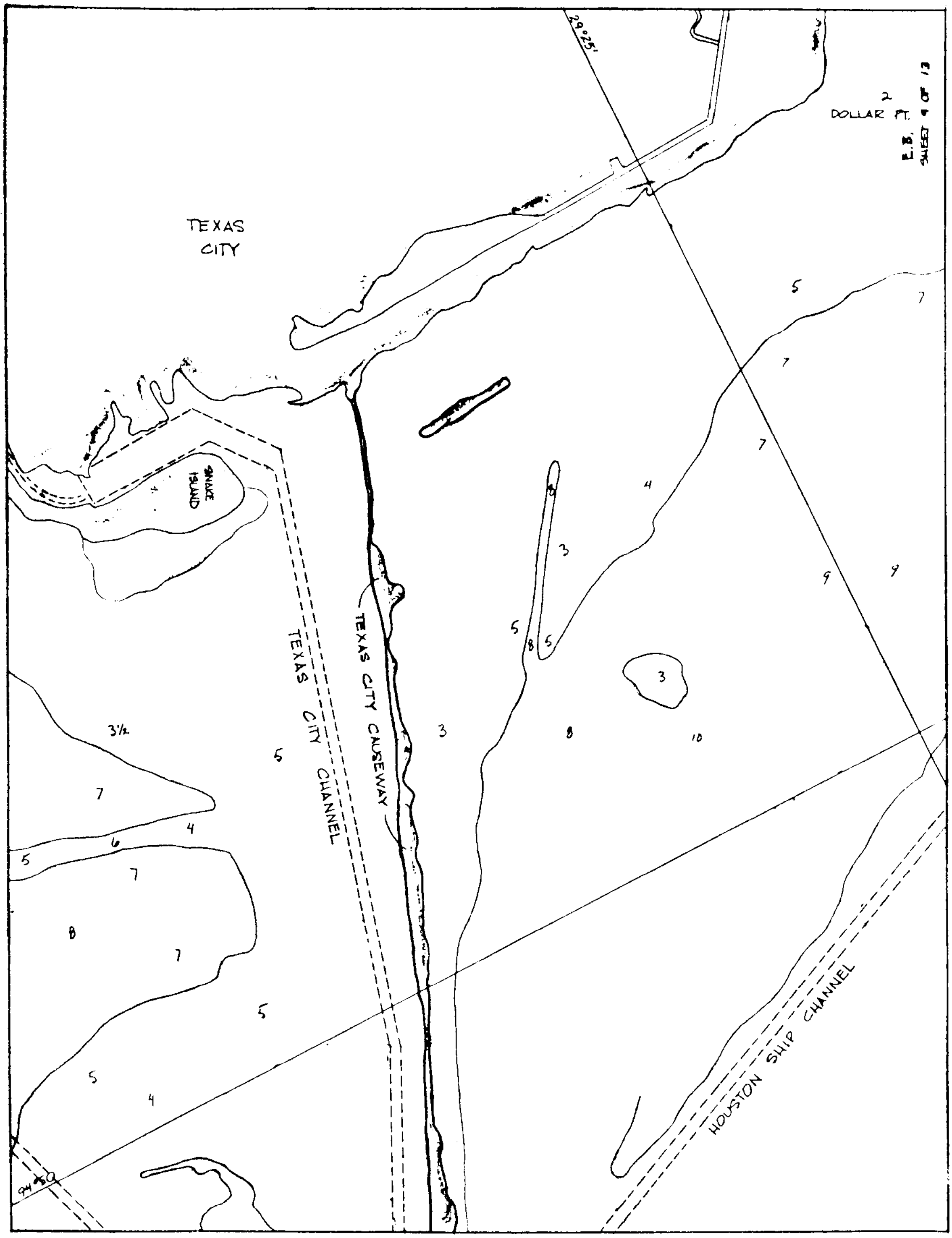

Figure B13. Northern Study Area: Texas City Channel.

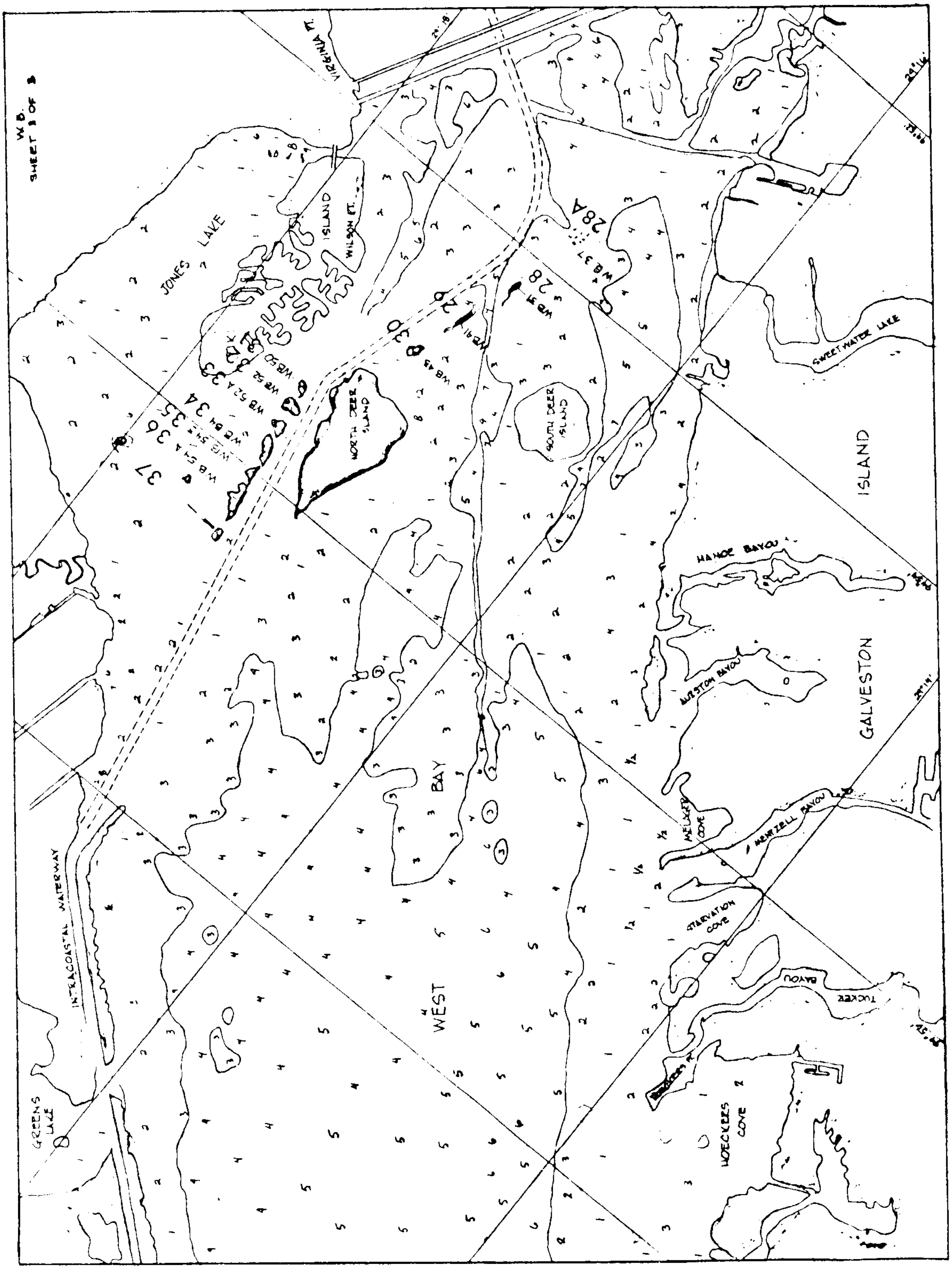

Figure B14. Northern Study Area: West Bay 28-37.

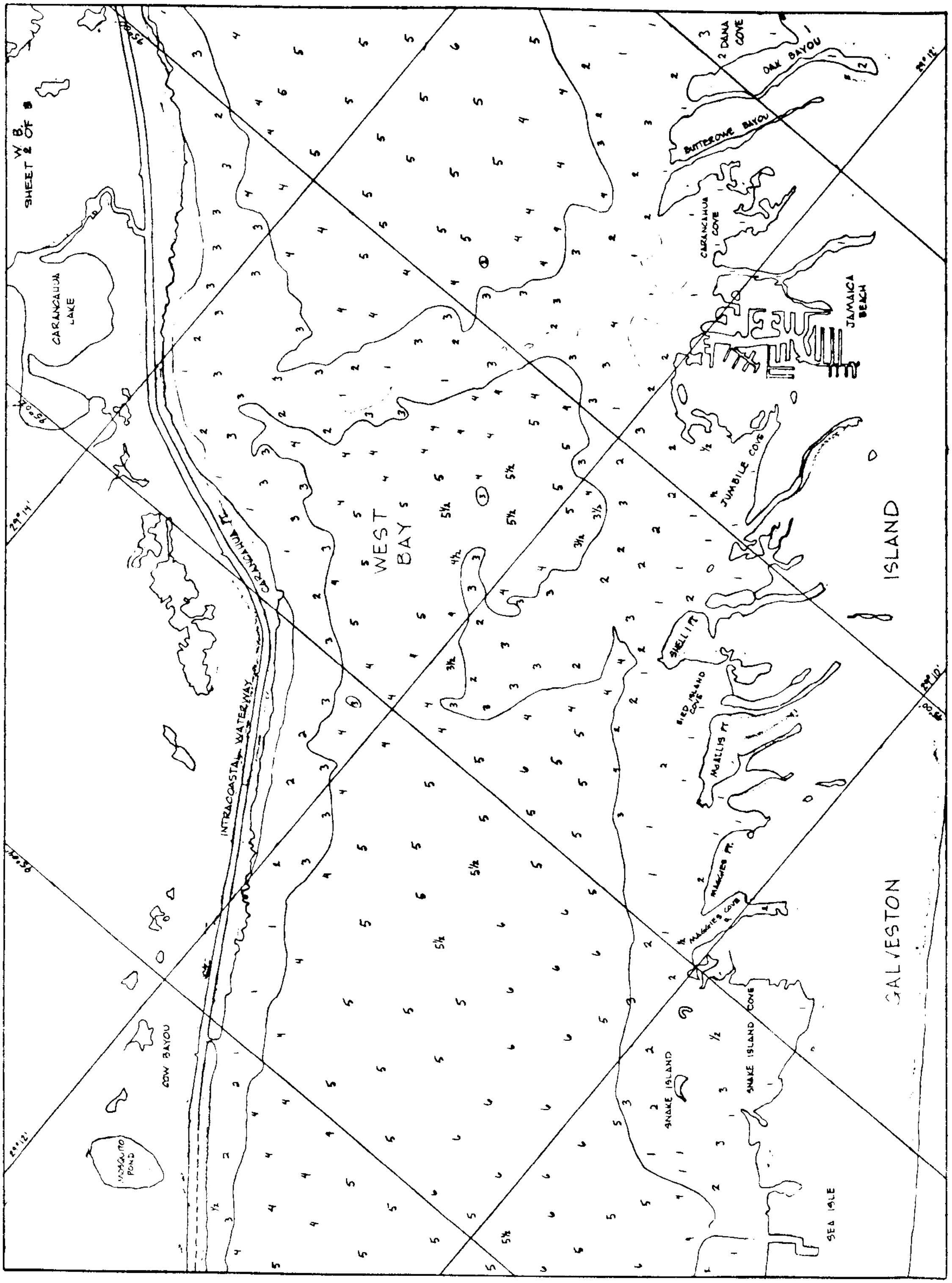

Figure B15. Northern Study Area: West Bay.

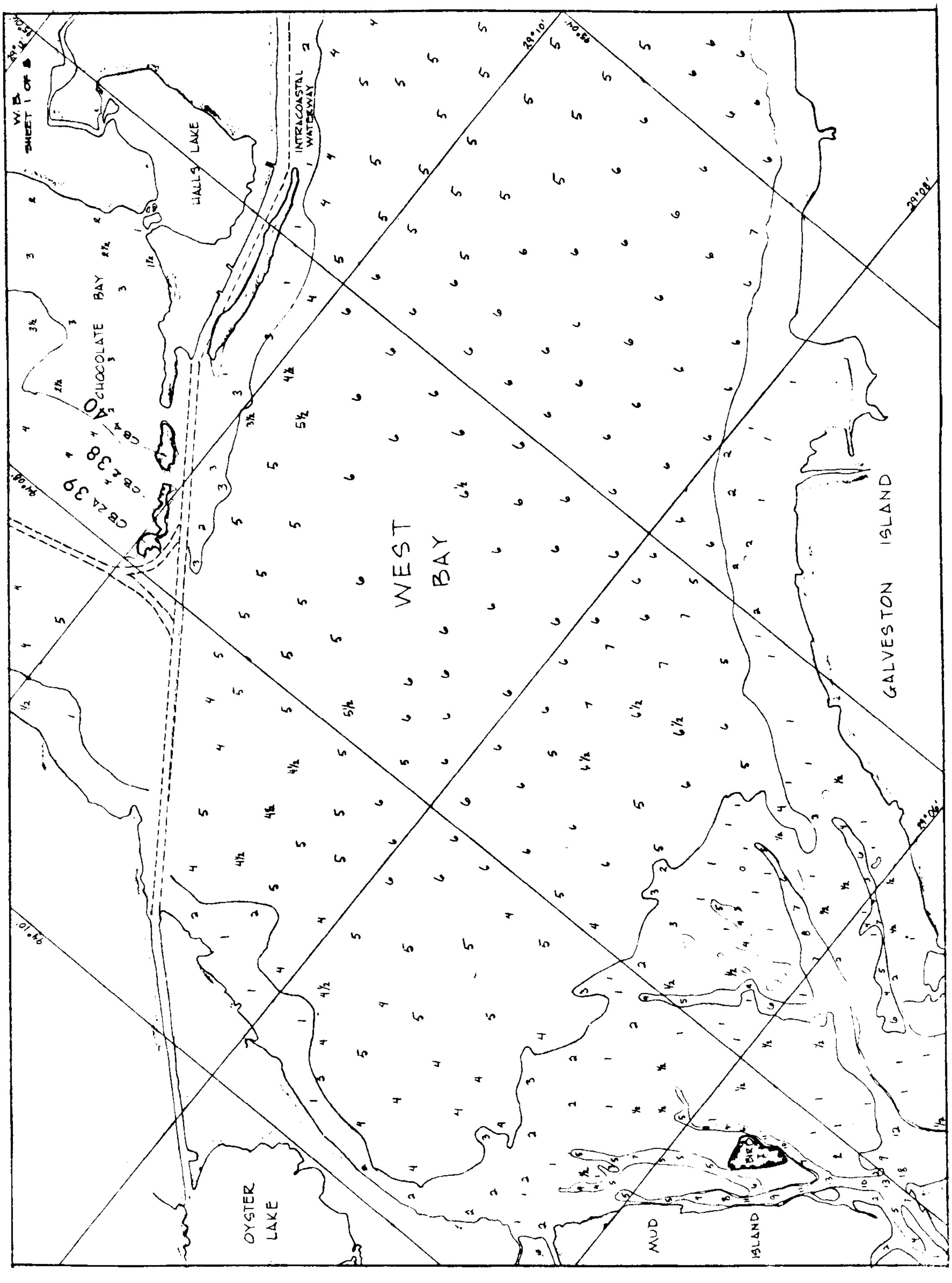

Figure B16. Northern Study Area: Chocolate Bay 38-40.

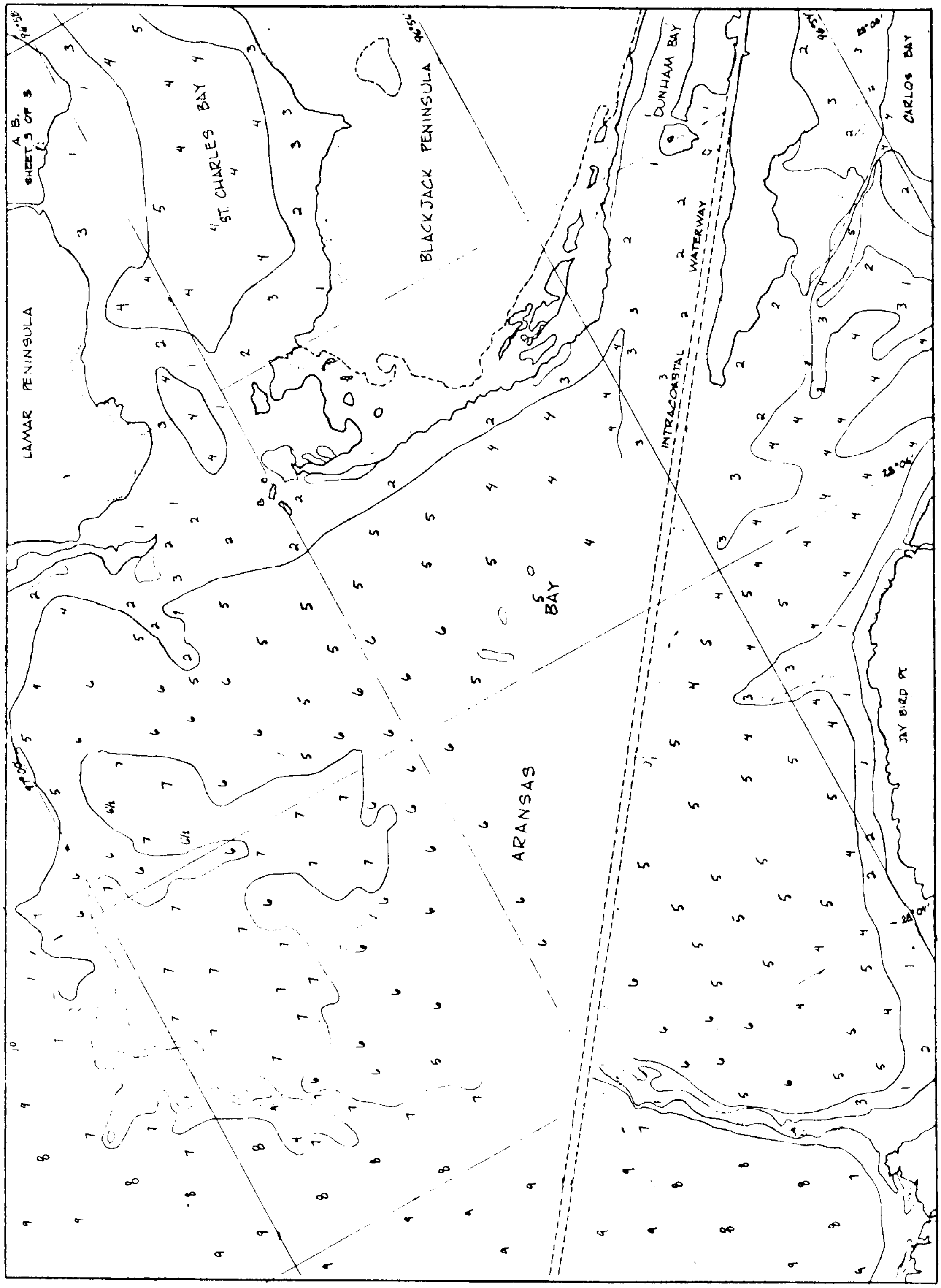

Figure B17. Southern Study Area: Aransas Bay.

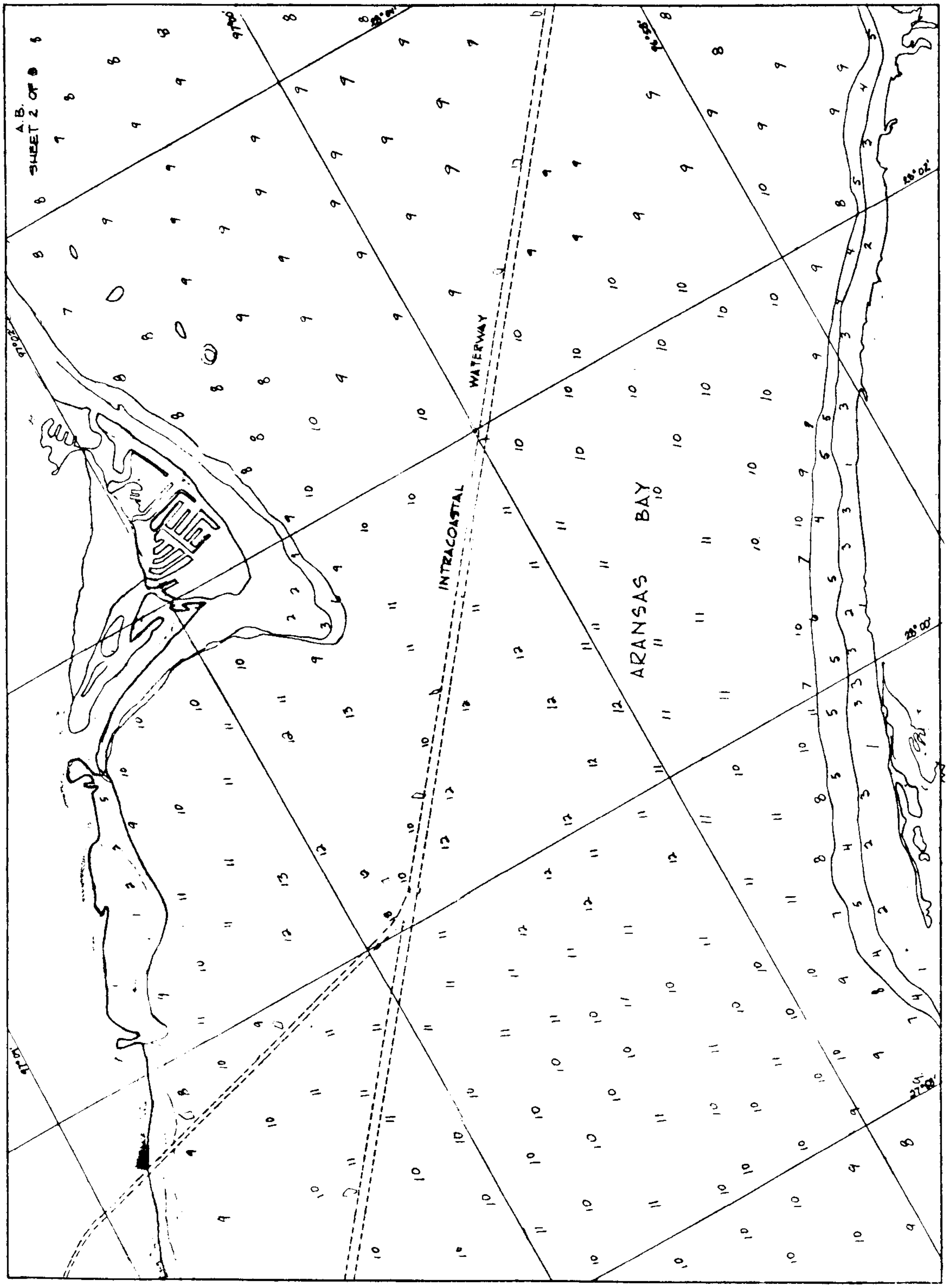

Figure B18. Southern Study Area: Aransas Bay.

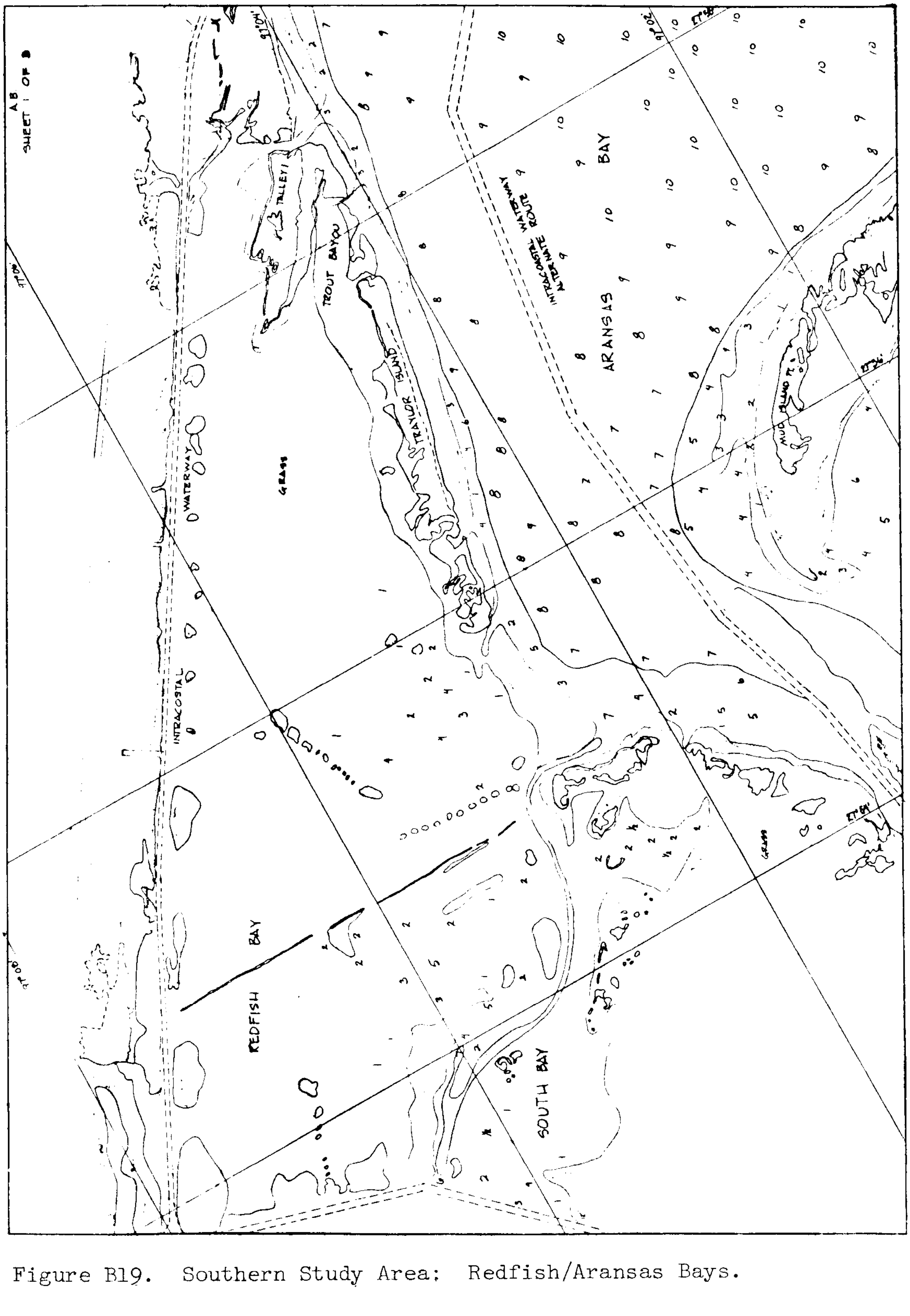

Figure B19. Southern Study Area: Redfish/Aransas Bays.

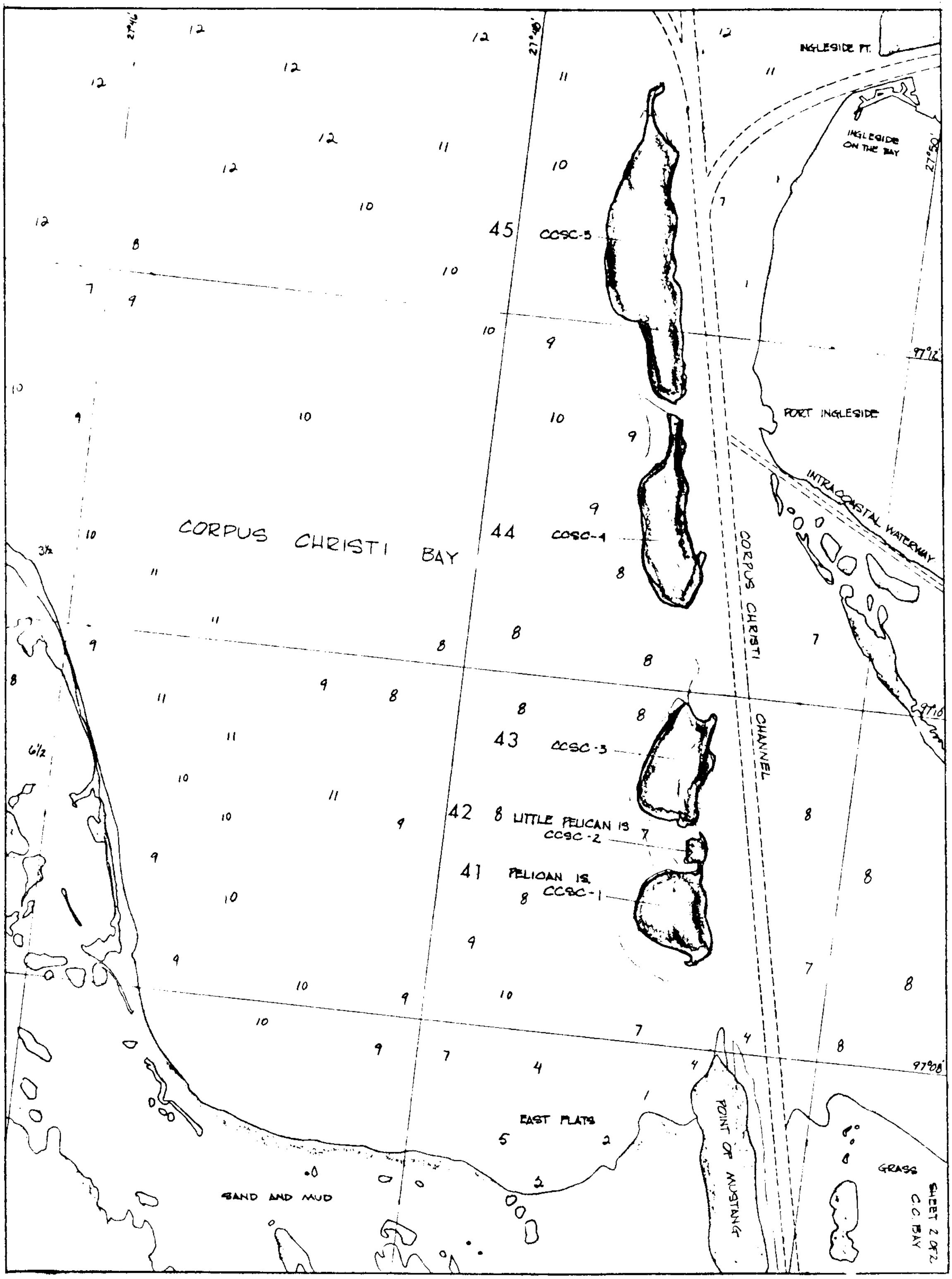

Figure B20. Southern Study Area: Corpus Christi Bay 41-45.

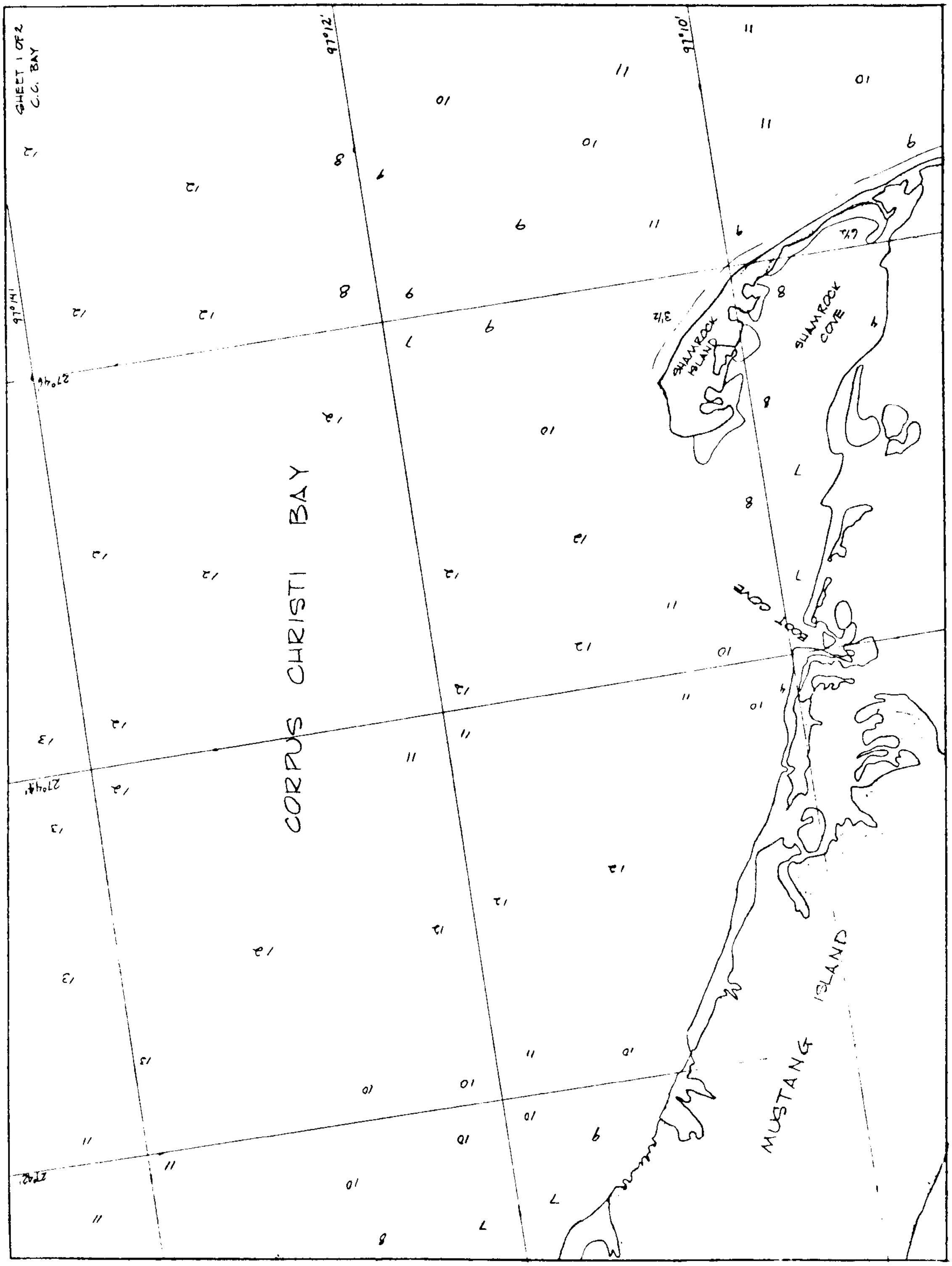

Figure B21. Southern Study Area: Corpus Christi Bay.

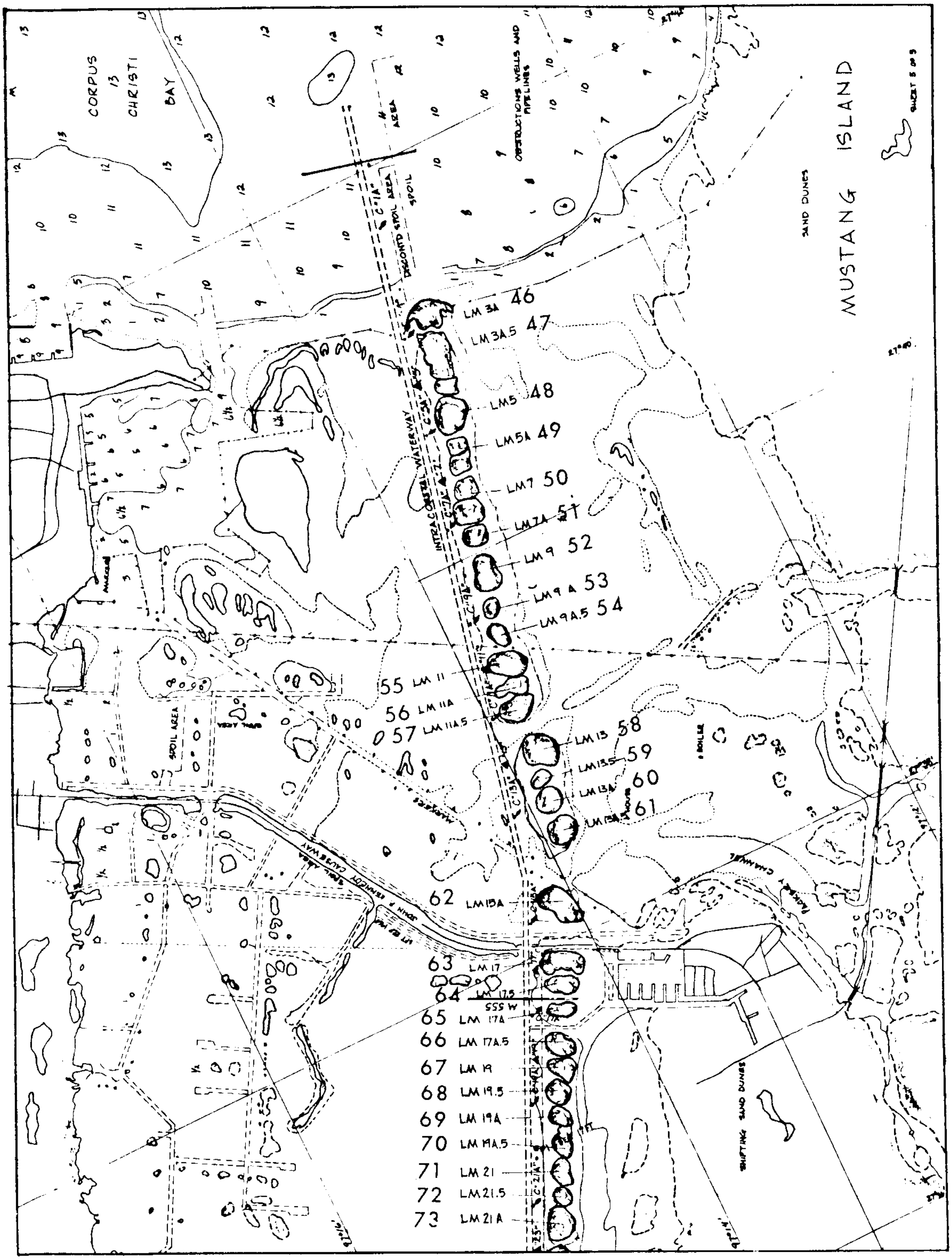

Figure B22. Southern Study Area: Laguna Madre 46-73.

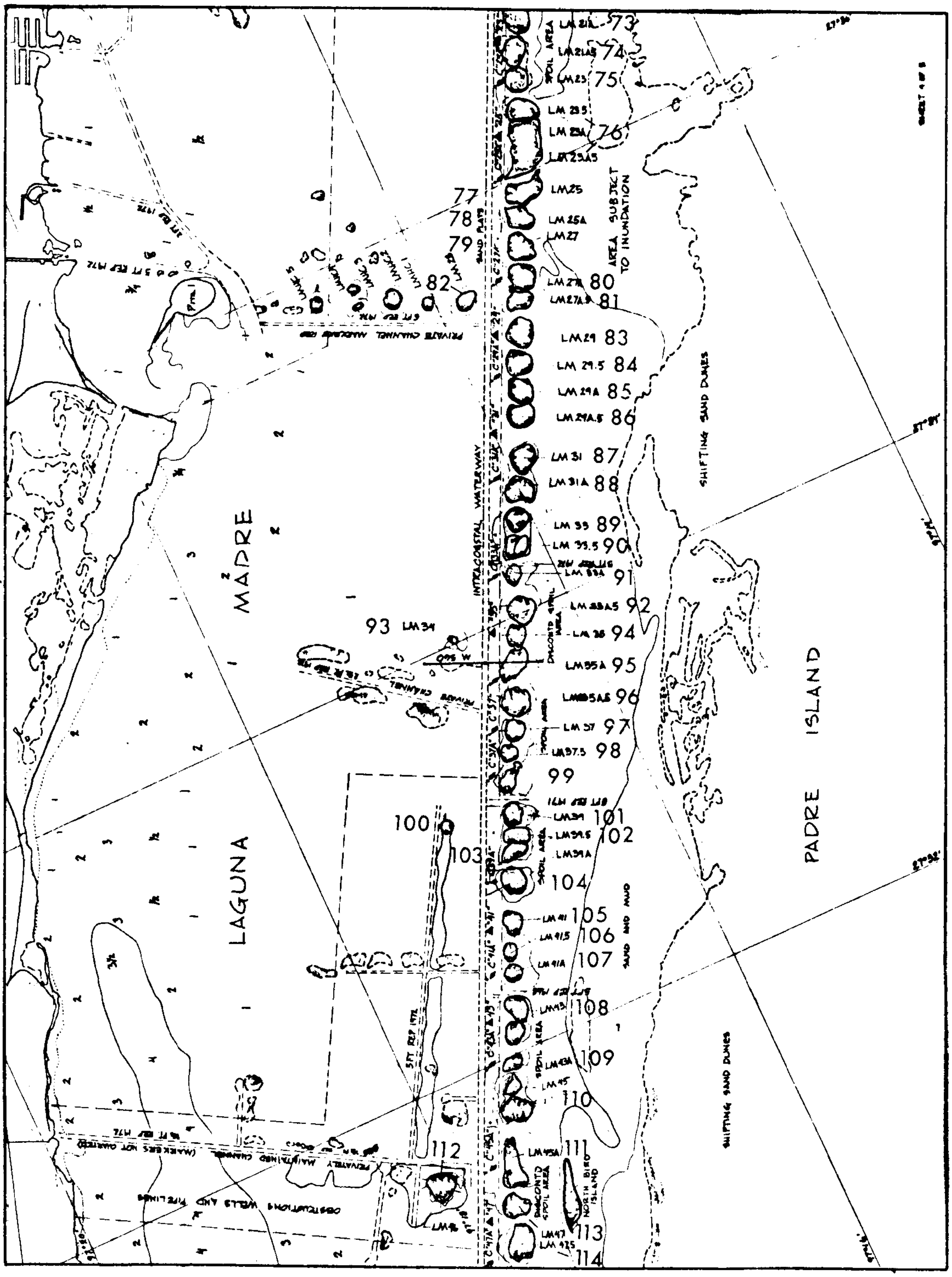

Figure B23. Southern Study Area: Laguna Madre 73-114.

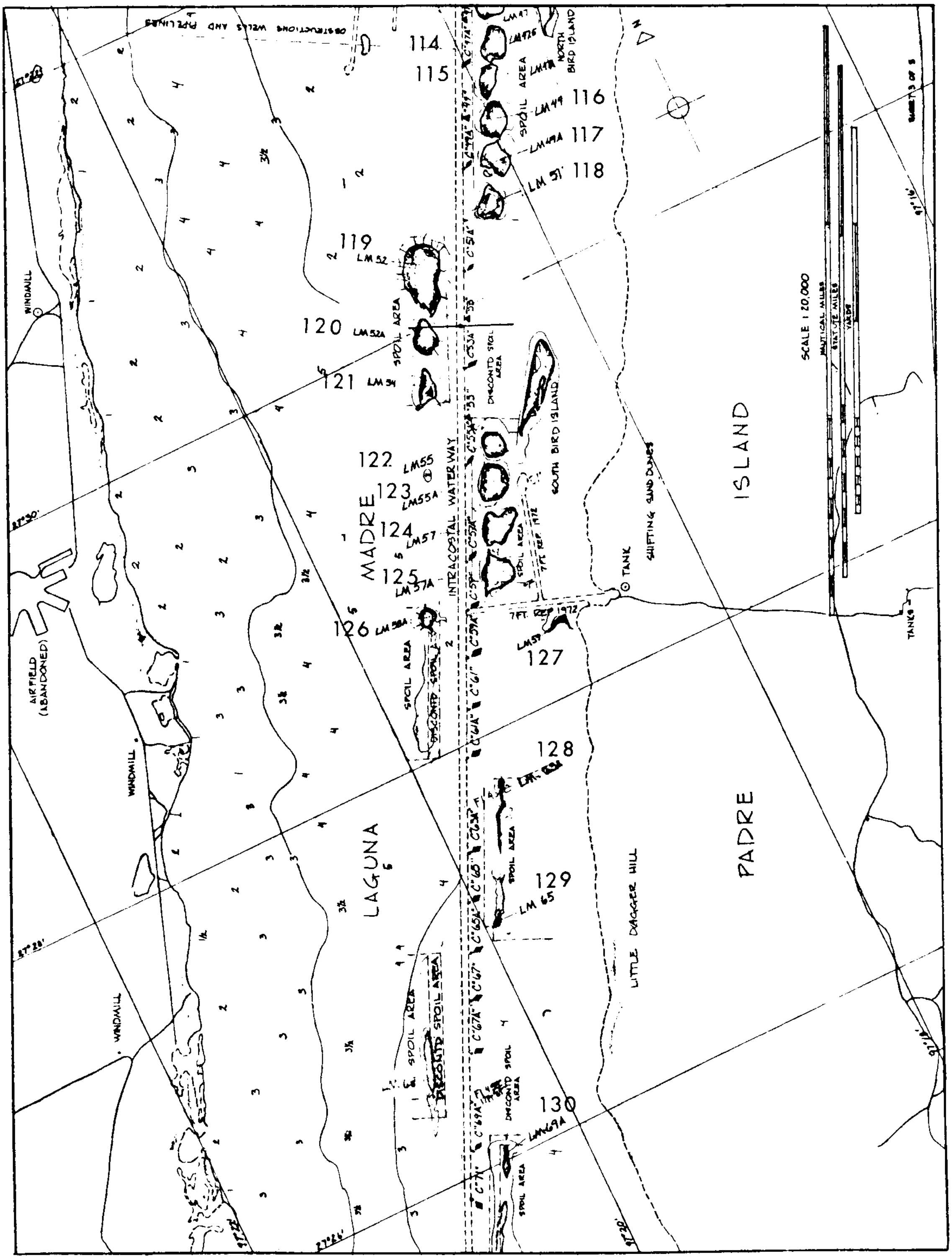

Figure B24. Southern Study Area: Laguna Madre 114-130.

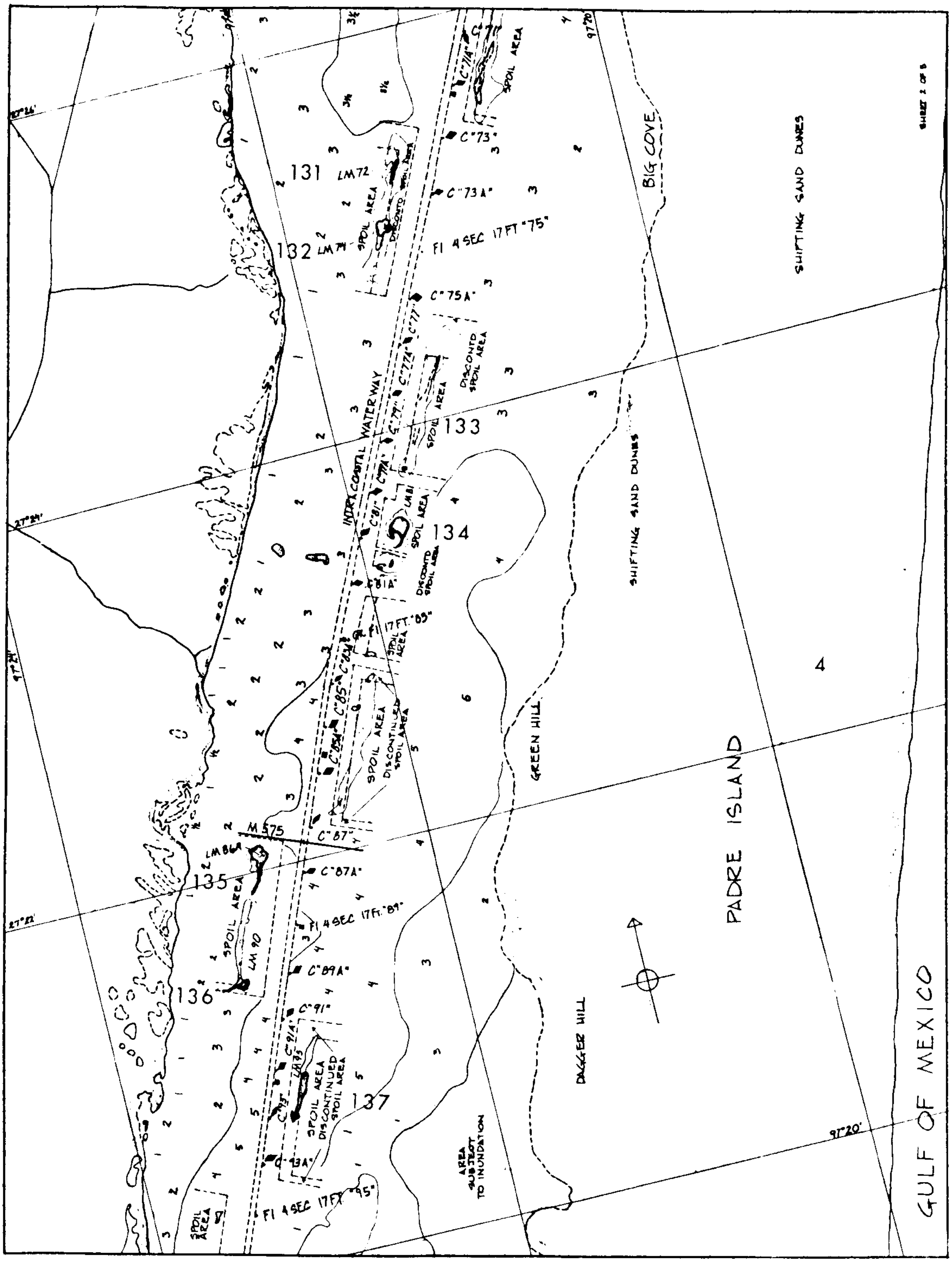

Figure B25. Southern Study Area. Laguna Madre 131-137.

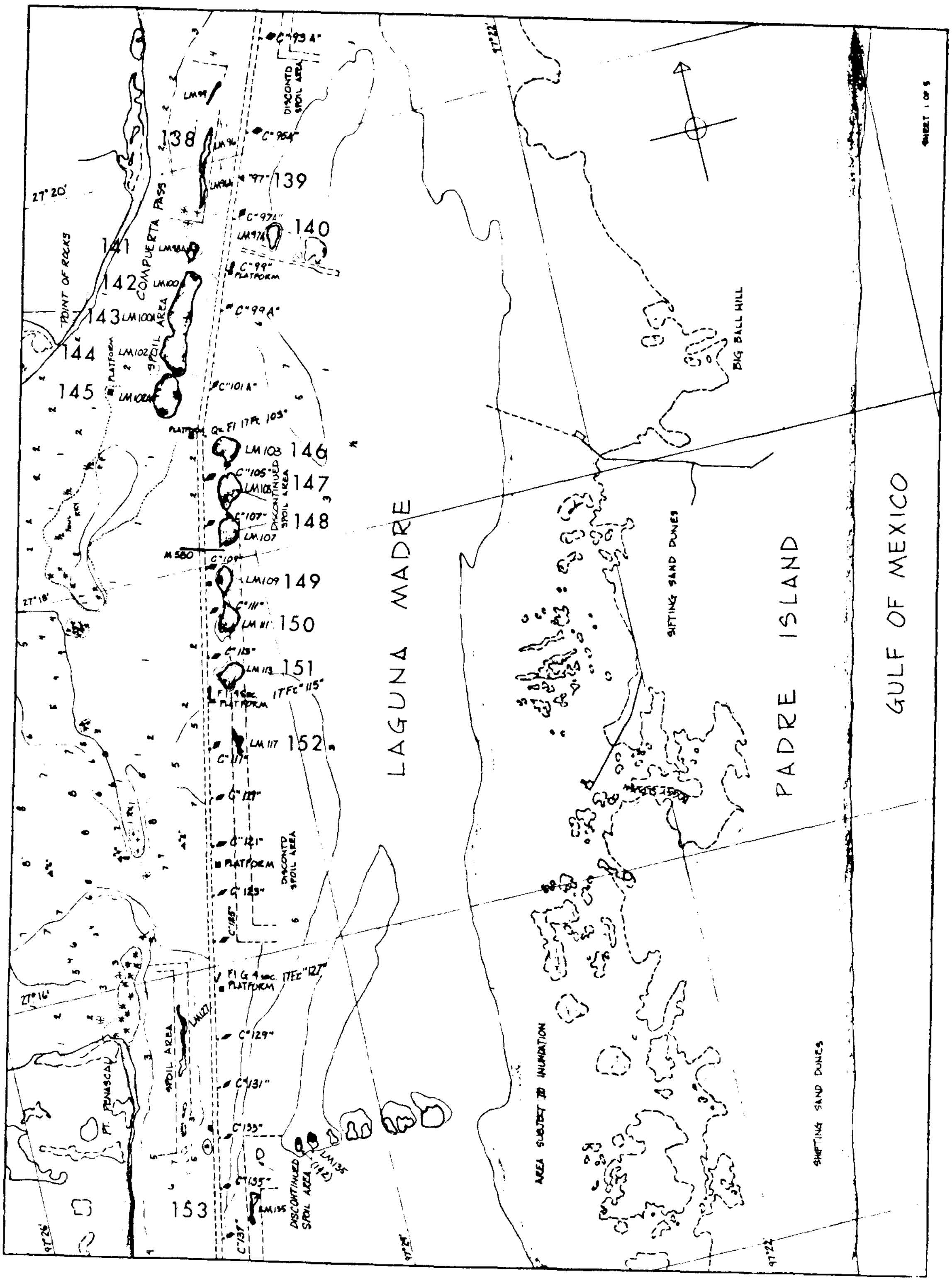

Figure B26. Southern Study Area: Laguna Madre 138-153.

APPENDIX C: NAME, DESIGNATION, LOCATION AND PHYSICAL CHARACTERISTICS OF ISLANDS IN THE SPECIFIC STUDY AREAS.

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
	Rollover Bay #1										
1	RB-1	94°30'	29°31'	205.7	91.4	1.5	1.6	1938-1939	Mar. '68 - July '68	none	2 areas of high dense vegetation-remainder of island low grass and shrubs-1 freshwater pond
2	RB-2	94°30'	29°31'	80.2	43.0	0.7	1.1	1938-1939	Mar. '68 - July '68	none	*Iva frutescens*, *Opuntia Lindheimeri*, *Distichlis spicata*, *Borrichia frutescens*, *Spartina alterniflora*
3	RB-3	94°30'	29°31'	97.2	45.7	0.7	1.1	1938-1939	Mar. '68 - July '68	none	large area of sparsely vegetated mud and shell-center with dense brush-large *Opuntia L.* clump
4	RB-4	94°30'	29°31'	94.2	71.3	0.7	0.9	1938-1939	Mar. '68 - July '68	none	*Spartina a.*, *Borrichia f.*, *Batis maritima*, *Sesuvium Portulacastrum*, 2 *Opuntia L.*
	Trinity River Channel #1										
5	TRC-1	94°43'	29°36'	337.1	54.3	0.7	1.8	1949	none	none	*Baccharis halimifolia*, *Salix nigra*, *Rubus trivialis*, *Spartina a.*, *Sesbania Drummondii*, *Arundo Donax*
6	TRC-2	94°44'	29°35'	254.2	54.3	0.7	1.5	1949	none	none	*Tamarix* spp., *Iva f.*, *Gaura brachycarpa*
7	TRC-3	94°44'	29°35'	457.2	37.2	0.7	1.2	1949	none	none	*Tamarix* spp., *Spartina a.*, *Baccharis h.*
8	TRC-4	94°44'	29°35'	105.8	14.3	0.6	0.9	natural	none	none	Almost completely shell
9	TRC-5	94°46'	29°33'	828.1	85.7	4.1	0.6	1949	none	none	*Spartina* spp.
10	TRC-6	94°46'	29°33'	246.9	38.1	0.9	0.6	1949	none	none	*Spartina* spp.
11	TRC-7	94°46'	29°33'	40.0	20.0	0.6	0.9	1949	1973-1974	none	*Spartina patens*, *Tamarix* spp., *Nerium Oleander*

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
12	TRC-8	94°46'	29°33'	85.7	28.4	0.3	0.9	natural	none	none	*Tamarix* spp.
13	TRC-9	94°47'	29°33'	1409.4	304.8	14.8	1.1	natural with deposition	-	none	*Baccharis h.*, *Opuntia L.*, *Spartina a.*
14	Smith Point Island TRC-10	94°47'	29°32'	705.9	100.0		1.4	1949	1963	none	Dense 4-6 m brush and trees - *Tamarix* spp., *Iva f.*, *Gaura brachycarpa*
15	Anahuac Channel #1 AC-1	94°43'	29°44'	371.6	143.0	3.8	unknown	unknown	unknown	none	unknown
16	AC-2	94°43'	29°44'	104.6	57.0	0.9	unknown	unknown	unknown	none	unknown
17	AC-3	94°43'	29°44'	104.6	9.5	0.1	unknown	unknown	unknown	none	unknown
18	Houston Ship Channel Bulkhead Reef HSC-76	94°56'	29°36'	432.2	394.4	6.1	2.2	1892	Oct. '72 - Feb. '73	none	*Spartina* spp. dominated south end - heavy brush and trees - *Baccharis h.*, & *Iva f.*
19	Houston Ship Channel HSC-78-80	94°57'	29°39'	1866.9	1066.8	189.9	2.3	1892	Oct. '72 - Feb. '73	none	low vegetation and some trees
20	Atkinson Island (South) HSC-88	94°58'	29°41'	600.0	100.0	5.1	2.2	1892	Oct. '72 - Feb. '73	none	Low vegetation with some trees present - *Baccharis h.*, *Borrichia f.*, *Spartina p.*, *Andropogon glomeratus*
21	Atkinson Island (North) HSC-90	94°58'	29°41'	400.0	150.0	4.5	2.0	1892	Oct. '72 - Feb. '73	none	Complex vegetation-marsh- *Celtis Lindheimeri*, *Zanthoxylum Clava-Herculis*
22	Scott Bay #1 HSC-114	95°02'	29°44'	500.0	150.0	3.6	-	-	Apr. '75 - July '75	none	submerged
23	Scott Bay #2 HSC-116	95°02'	29°44'	423.1	154.2	2.9	5.4	natural with deposition	Apr. '75 - July '75	none	Predominantly barren spoil

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
24	Scott Bay #3 HSC-118	95°03'	29°44'	211.5	125.9	1.9	1.3	natural with deposition	Apr. '75 - July '75	none	Complex vegetation - *Arundo D.*, *Baccharis h.*, *Rosa bracteata*
25	Scott Bay #4 HSC-120	95°03'	29°45'	377.3	145.7	4.1	4.6	as above	Apr. '75 - July '75	none	*Rosa b.*, *Baccharis h.*, *Zanthoxylum C.*
26	Scott Bay #5 HSC-124	95°03'	29°45'	463.0	143.0	5.6	1.7	as above	Apr. '75 - July '75	none	*Opuntia L.*, *Rosa b.*, *Arundo D.*, *Zanthoxylum C.*, *Baccharis h.*
27	Galveston Bay Freeport Channel Little Pelican Is. GBFC-11-13	94°49'	29°21'	1063.1	828.8	48.2	2.2	as above	Aug. '54 - Dec. '54	none	*Baccharis h.*, *Borrichia f.*, *Spartina p.*, *Batis m.*
28A	West Bay Jigsaw Island WB-37	94°54'	29°17'	-	-	-	1.2	1973	none	none	*Suaeda linearis*, *Opuntia L.*, *Salicornia virginica*, *Borrichia f.*, *Spartina a.*, *Lycium carolinianum*
28	WB-39	94°54'	29°17'	197.2	31.4	0.1	3.7	Apr. '33 - Feb. '34	-	none	*Cynodon Dactylon*, *Iva f.*
29	High Bank WB-41	94°55'	29°17'	100.0	7.9	0.1	4.5	Apr. '33 - Feb. '34	May '52 - July '52	none	*Hordeum vulgare*, *Cynodon D.* - Recently burned
30	Down North Deer WB-43	94°55'	29°17'	148.7	100.0	0.7	2.5	Apr. '33 - Feb. '34	May '52 - July '52	none	*Borrichia f.*, *Baccharis h.*, *Lycium c.*, *Opuntia L.*, *Spartina spartinae*
31	WB-50	94°55'	29°17'	160.0	43.0	0.6	1.8	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Iva f.*, *Opuntia L.*, *Spartina a.*
32	WB-52	94°56'	29°17'	151.5	100.0	1.3	3.4	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Iva f.*, *Lycium c.*, *Opuntia L.*, *Lantana horrida*, *Urtica chamaedryoides*
33	WB-52A	94°56'	29°17'	185.6.	134.4	1.9	4.0	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Baccharis h.*, *Opuntia L.*, *Spartina a.*, *Lycium c.*, *Urtica c.*, *Galium Aparine*
34	WB-54	94°56'	29°17'	342.9	105.8	2.2	3.4	Apr. '33 - Feb. '34	May '74 - Apr. '75	2 houses	*Iva f.*, *Baccharis h.*, *Opuntia L.*, *Borrichia f.*, *Batis m.*, *Spartina a.*
35	WB-54.5	94°56'	29°17'	185.6	51.5	0.4	3.4	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Iva f.*, *Opuntia L.*, *Borrichia f.*

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
36	WB-54A	94°56'	29°17'	347.8	80.2	2.2	3.4	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Iva f.*, *Opuntia L.*, *Borrichia f.*, *Batis m.*, *Salicornia v.*, *Spartina a.*
37	WB-56	94°56'	29°17'	275.5	75.9	0.3	2.7	Apr. '33 - Feb. '34	May '74 - Apr. '75	none	*Iva f.*, *Opuntia L.*, *Borrichia f.*, *Batis m.*, *Salicornia v.*, *Spartina a.*
	Chocolate Bay #2										
38	CB-2	95°08	29°10'	308.9	103.0	2.9	2.4	Nov. '38 - Sept. '39	May '74 - Apr. '75	6 buildings, 2 piers	*Andropogon g.*, *Batis m.*, *Spartina a.*- Vegetation altered by mowing and burning
39	CB-2A	95°08'	29°10'	480.1	251.5	2.2	1.2	Nov. '38 - Sept. '39	May '74 - Apr. '75	3 buildings, 3 piers	*Batis m.*, *Spartina a.*, *Salicornia* spp.
40	CB-4	95°07'	29°10"	405.7	151.5	3.1	2.4	Nov. '38 - Sept. '39	May '74 - Apr. '75	1 building, 2 houses	*Batis m.*, *Spartina a.*, *Andropogon g.*, *Baccharis h.*
	Corpus Christi Ship Channel Pelican Island										
41	CCSC-1	97°09'	27°49	819.0	733.0	41.2	-	1879-1915	1976	none	Halophytes, grasses, low shrubs, *Tamarix* spp.
	Little Pelican Island										
42	CCSC-2	97°09'	27°49'	323.7	157.1	2.4	-	1879-1915	none	none	Halophytes, grasses, low shrubs, *Tamarix* spp.
43	CCSC-3	97°09'	27°49'	1037.9	723.6	51.2	-	1879-1915	1976	2 cabins, 1 pier	low herbs and grasses - mostly barren
44	CCSC-4	97°09'	27°49'	1971.2	600.2	75.0	-	1879-1915	none	none	Mostly barren, low herbs and grasses
45	CCSC-5	97°12'	27°39'	2967.5	771.5	138.9	-	-	-	none	Barren south side - herbs, halophytes, and grasses
	Laguna Madre										
46	LM-3A	97°13'	27°40'	599.5	284.7	11.3	-	Dec. '45 - Jan. '47	Mar. '68 - Oct. '68	none	Grasses, halophytes, low herbs, *Sophora tomentosa*
47	LM-3A.5	97°13'	27°40'	666.6	352.4	25.2	-	Dec. '45 - Jan. '47	Mar. '68 - Oct. '68	none	Grasses, halophytes, low herbs, *Sophora t.*
48	LM-5	97°13'	27°40	476.1	380.7	10.4	-	Dec. '45 - Jan. '47	Mar. '68 - Oct. '68	none	Grasses, halophytes, low herbs, *Sophora t.*

APPENDIX C (Continued)

No.	Name or Designation	Longi-tude	Lati-tude	Max. Length (m)	Max. Width (m)	Area (ha)	Eleva-tion (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
49	LM-5A	97°13'	27°40'	361.8	284.7	9.8	-	Dec. '45 - Jan. '47	Apr. '62 - July '62	none	Grasses, halophytes, low herbs, *Prosopis glandulosa*
50	LM-7	97°13'	27°40'	399.9	304.8	11.1	-	Dec. '45 - Jan. '47	Apr. '62 - July '62	none	Grasses, halophytes, *Borrichia f.*, *Prosopis g.*
51	LM-7A	97°14'	27°40'	246.9	190.2	3.9	-	Dec. '45 - Jan. '47	Apr. '62 - July '62	none	Grasses, halophytes, low herbs, *Sophora t.*
52	LM-9	97°14'	27°40'	342.9	275.2	8.1	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
53	LM-9A	97°14'	27°40'	152.4	152.4	1.9	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
54	LM-9A.5	97°14'	27°39'	237.4	171.0	3.4	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
55	LM-11	97°14'	27°39'	323.7	180.7	7.0	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
56	LM-11A	97°14'	27°39'	284.7	155.5	3.5	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
57	LM-11A.5	97°14'	27°39'	304.8	199.6	5.4	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
58	LM-13	97°14'	27°39'	342.9	256.3	6.7	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
59	LM-13.5	97°14'	27°39'	166.4	114.0	1.7	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
60	LM-13A	97°14'	27°39'	198.1	190.2	3.4	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
61	LM-13A.5	97°14'	27°39'	209.1	171.3	10.0	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
62	LM-15A	97°14'	27°38'	377.0	330.1	6.8	2.3	Dec. '45 - Jan. '47	-	1 house-boat	medium grasses with 3 stands of *Baccharis neglecta*, *Opuntia L.*, 3 *Prosopis g.* trees

APPENDIX C (Continued)

No.	Name or Designation	Longi-tude	Lati-tude	Max. Length (m)	Max. Width (m)	Area (ha)	Eleva-tion (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
63	LM-17	97°14'	27°38'	361.8	228.0	8.9	-	Dec. '45 - Jan. '47	-	1 bridge, 7 houses, 10 piers	Typical, low, halophytic, herbaceous
64	LM-17.5	97°14'	27°38'	333.2	190.2	5.0	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
65	LM-17A	97°14'	27°38'	284.7	180.7	3.6	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
66	LM-17A.5	97°15'	27°38'	284.7	190.2	4.5	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
67	LM-19	97°14'	27°37'	304.8	275.2	6.8	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
68	LM-19.5	97°14'	27°37'	275.2	209.1	5.9	-	Dec. '45 - Jan. '47	-	none	Typical, low, halophytic, herbaceous
69	LM-19A	97°15'	27°37'	275.2	256.3	7.1	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
70	LM-19A.5	97°17'	27°37'	294.7	275.2	6.8	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
71	LM-21	97°15'	27°37'	304.8	246.9	5.3	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
72	LM-21.5	97°15'	27°37'	228.0	228.0	5.0	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
73	LM-21A	97°15'	27°37'	304.8	265.8	5.1	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
74	LM-21A.5	97°15'	27°37'	284.7.	265.8	5.1	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
75	LM-23	97°15'	27°37'	246.9	228.0	5.2	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
76	LM-23A.5-23.5	97°15'	27°37'	723.9	274.3	21.0	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin	Typical, low, halophytic, herbaceous

APPENDIX C (Continued)

No.	Name or Designation	Longi- tude	Lati- tude	Max. Length (m)	Max. Width (m)	Area (ha)	Eleva- tion (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
77	LM-25	97°15'	27°63'	418.8	171.6	6.4	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
78	LM-25A	97°15'	27°63'	274.3	179.5	3.8	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
79	LM-27	97°15'	27°36'	246.3	228.0	4.3	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin	Low, herbaceous
80	LM-27A	97°15'	27°36'	275.2	234.7	5.4	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin	Low, herbaceous
81	LM-27A.5	97°16'	27°35'	243.8	182.9	3.2	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin 1 pier	Typical, low, halophytic, herbaceous
82	LM-28	97°16'	27°36'	167.6	133.5	1.8	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	2 cabins 1 pier	Typical, low, halophytic, herbaceous
83	LM-29	97°16'	27°35'	246.9	246.9	4.7	1.2	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin	Low, herbaceous
84	LM-29.5	97°16'	27°35'	265.8	256.3	4.9	0.9	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	none	Low, herbaceous
85	LM-29A	97°16'	27°35'	246.9	246.9	4.7	1.2	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin	Low, herbaceous
86	LM-29A.5	97°16'	27°35'	260.9	228.6	4.3	1.2	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 cabin 1 pier	Herbaceous
87	LM-31	97°16'	27°35'	234.4	202.1	3.8	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	2 cabins 1 outhouse	Typical, low, halophytic, herbaceous
88	LM-31A	97°16'	27°35'	312.4.	243.8	5.6	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin	Low, herbaceous
89	LM-33	97°16'	27°34'	269.1	260.9	4.9	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	2 cabins 1 pier	Herbaceous
90	LM-33.5	97°16'	27°34'	337.1	259.1	5.9	2.1	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	3 cabins 1 pier	Typical, low, halophytic, herbaceous

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structure	Vegetation
91	LM-33A	97°16'	27°34'	173.4	135.3	1.8	1.8	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	4 cabins 2 piers	Low, herbaceous
92	LM-33A.5	97°16'	27°34'	230.1	207.6	4.5	1.8	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	4 cabins 1 pier	Typical, low, halophytic, herbaceous
93	LM-34	97°17'	27°34'	82.0	66.8	0.4	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin	Very limited vegetation
94	LM-35	97°16'	27°34'	219.2	152.4	3.1	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin 1 pier	Typical, low, halophytic, herbaceous
95	LM-35A	97°17'	27°34'	202.1	141.1	3.8	1.3	Dec. '45 - Jan. '47	June '74 - Nov. '74	1 cabin 1 pier 1 outhouse	Low, herbaceous with a stand of sparse unidentified trees on summit, 2 freshwater ponds present
96	LM-35A.5	97°16'	27°34'	228.6	202.1	3.9	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	2 cabins 1 pier 1 outhouse	Typical, low, halophytic, herbaceous
97	LM-37	97°17'	27°33'	301.5	232.6	-	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	3 cabins 2 piers	Limited, low, herbaceous
98	LM-37.5	97°17'	27°33'	219.2	211.5	3.6	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic, herbaceous
99	LM-37A	97°17'	27°33'	350.3	167.6	6.1	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	1 cabin	Limited, low, herbaceous
100	LM-38	97°19'	27°33'	186.5	156.4	2.1	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	1 cabin 1 floating dock	Typical, low, halophytic, herbaceous
101	LM-39	97°17'	27°33'	219.2	179.5	7.0	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	2 cabins 2 piers	Low, herbaceous
102	LM-39.5 (large)	97°17'	27°33'	228.6	167.6	3.1	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic, herbaceous
103	LM-39.5 (small)	97°17'	27°33'	217.3	114.3	1.9	-	Dec. '45 - Jan. '47	June '74 - Nov. '74	2 cabins 1½ piers	Low herbaceous, sparse barren

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
104	LM-39A	97°17'	27°33'	299.3	233.8	4.4	2.9	Dec. '45 - Jan. '47	(recent deposition on back side) June '74 - Nov. '74	1 cabin 1 pier 1 outhouse 1 watertank	Sparse vegetation on new dredged material - dense grass and 1 *Prosopis g.* on older dredged material
105	LM-41	97°17'	27°33'	224.9	209.7	3.9	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin 1 pier	Low herbs and grasses- 1 *Prosopis g.*
106	LM-41.5	97°17'	27°32'	222.8	120.1	3.5	-	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin 1 pier	Low herbs and grasses- *Tamarix* spp., *Nerium O.*
107	LM-41A	97°17'	27°32'	242.9	184.7	3.6	1.5	Dec. '45 - Jan. '47	Aug. '66 - Mar. '67	1 cabin 1 pier	Low herbs and grasses
108	LM-43	97°17'	27°32'	421.5	277.4	11.1	2.5	Dec. '45 - Jan. '47	Aug. '66 Mar. '67	1 partial pier	Dense herbs and grasses with scattered *Tamarix* spp.
109	LM-43A	97°17'	27°32'	245.7	191.8	2.8	3.7	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	1 partial pier	Sparse vegetation on new dredged material - dense grass and *Tamarix* spp. on remainder of island
110	LM-45	97°17'	27°32'	497.1	295.4	9.2	1.8	Dec. '45 - Jan. '47	(recent deposition on north end) Jan. '62 - Apr. '62	1 cabin 2 partial piers	Low, herbaceous
111	LM45A	97°18'	27°31'	485.6	232.6	7.7	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	6 cabins, oil tank complex & 3 partial piers	Low, herbaceous
112	LM-46	97°18'	27°31'	260.9	217.3	4.7	-	Dec. '45 - Jan. '47	Jan. '62 - Apr. '62	9 cabins 5 piers	Typical, low, halophytic, herbaceous
113	LM-47	97°18'	27°31'	178.3	174.7	3.9	2.9	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	none	Sparse vegetation on walls of dike - otherwise bare
114	LM-47.5	97°18'	27°31'	325.2	190.8	5.4	2.3	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	none	Sparse vegetation-scattered *Tamarix* spp., 1 *Prosopis g.*, *Opuntia L.*, *Typha domingensis*

APPENDIX C (Continued)

No.	Name or Designation	Longi- tude	Lati- tude	Max. Length (m)	Max. Width (m)	Area (ha)	Eleva- tion (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
115	LM-47A	97°18'	27°31	243.8	140.2	3.4	1.5	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	8 partial piers	Scattered *Tamarix* spp., *Nerium O.* - Halophytes, grasses and sedged in low area - diked pond present
116	LM-49	97°18'	27°31'	299.0	257.3	6.3	2.1	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	1 cabin 1 pier	Low, herbaceous
117	LM-49A	97°18'	27°31'	297.2	284.7	6.2	-	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	none	Low, sparse, herbaceous
118	LM-51	97°18'	27°30'	291.1	226.2	4.9	4.0	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	2 partial cabins and piers, 1 shed	Sparse vegetation on recent dredged material deposition--*Nerium O.*, *Opuntia L.*, herbs and grasses on rest of island
119	LM-52	97°19'	27°30'	595.9	318.2	15.9	-	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	18 cabins 13 piers numerous outhouses	Low, herbaceous
120	LM-52A	97°19'	27°30'	333.2	224.9	5.0	-	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	6 cabins 4 piers	Low, herbaceous
121	LM-54	97°19'	27°30'	304.8	137.2	3.2	-	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	5 cabins 2 piers	Low, herbaceous
122	LM-55	97°18'	27°29'	261.2	210.6	3.7	1.8	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	1 cabin foundation	*Prosopis g.*, *Opuntia L.*, *Andropogon g.*, *Tamarix* spp. - Halophytes
123	LM-55A	97°19'	27°29'	283.8	211.5	5.0	1.8	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	none	Typical, low, halophytic, herbaceous
124	LM-57	97°18'	27°29'	307.9	253.6	7.2	1.9	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	2 cabins 2 outhouses 2 partial piers	Halophytes on perimeter - *Tamarix* spp., *Baccharis n.*, *Prosopis g.*
125	LM-57A	97°19'	27°29'	402.3	322.5	7.4	1.9	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	2 fallen cabins	*Tamarix* spp., *Opuntia L.*, *Borrichia f.*
126	LM-58A	97°20'	27°29'	190.2	171.3	1.5	-	Apr. '47 - Mar. '48	Jan. '62 - Apr. '62	4 cabins 4 piers outhouses	Typical, low, halophytic, herbaceous

APPENDIX C (Continued)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
127	LM-59	97°19'	27°28'	114.0	104.6	0.4	-	Apr. '47 - Mar. '48	July '65 - Feb. '66	none	Typical, low, halophytic, herbaceous
128	LM-63A	97°20'	27°28	295.1	23.5	0.5	0.9	Apr. '47 - Mar. '48	June '74 - Nov. '74	foundation and old pilings	Low, herbaceous - Typical halophytes
129	LM-65	97°20'	27°27'	71.3	28.4	0.3	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	none	Typical, low, halophytic, herbaceous
130	LM-69A	97°21'	27°26'	246.9	38.1	0.6	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic, herbaceous
131	LM-72	97°21'	27°25'	104.6	9.5	0.1	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	3 cabins	Typical, low, halophytic, herbaceous
132	LM-74	97°21'	27°25'	28.4	18.9	0.1	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin 1 outhouse	Typical, low, halophytic, herbaceous
133	LM-77A	97°21'	27°24'	66.5	18.9	0.1	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	none	Typical, low, halophytic, herbaceous
134	LM-81	97°22'	27°23'	184.4	130.5	1.7	1.7	Apr. '47 - Mar. '48	June '74 - Nov. '74	none	Dominant is *Baccharis n.*, halophytes also present
135	LM-86A	97°23'	27°21'	390.5	152.4	3.1	-	Apr. '47 - Mar. '48	Apr. '70 - Nov. '74	3 cabins 2 piers	Typical, low, halophytic, herbaceous
136	LM-90	97°23'	27°21'	170.7	66.5	0.4	-	Apr. '47 - Mar. '48	June '74 - Nov. '70	1 cabin 1 pier	Typical, low, halophytic, herbaceous
137	LM-93	97°23'	27°21'	190.2	28.4	0.3	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin 2 piers	Typical, low, halophytic vegetation and grasses
138	LM-96	97°24'	27°20'	338.0	47.6	1.5	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic vegetation and grasses
139	LM-96A	97°24'	27°20'	314.3	47.6	0.1	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	3 cabins 3 piers	Typical, low, halophytic vegetation and grasses
140	LM-97A	97°23'	27°20'	132.9	95.1	1.3	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin on stilts	Typical, low, halophytic vegetation and grasses

APPENDIX C (Concluded)

No.	Name or Designation	Longitude	Latitude	Max. Length (m)	Max. Width (m)	Area (ha)	Elevation (m)	Date of Construction	Recent Dredged Material Deposition	Man Made Structures	Vegetation
141	LM-98A	97°24'	27°20'	157.3	75.9	1.2	-	Apr. '47 - Mar. '48	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic vegetation and grasses
142	LM-100	97°24'	27°19'	213.7	142.3	2.3	-	Apr. '47 - Mar. '48	Apr. '70 - June '70	5 cabins 2 outhouses 2 piers	Typical, low, halophytic vegetation, grasses and shrubs
143	LM-100A	97°24'	27°19'	342.9	213.7	5.5	-	Apr. '47 - Mar. '48	Apr. '70 - June '70	2 cabins 1 pier	Typical, low, halophytic vegetation, grasses and shrubs
144	LM-102	97°24'	27°19'	380.7	218.5	6.3	-	Apr. '47 - Mar. '48	Apr. '70 - June '70	2 cabins 2 piers	Typical, low, halophytic vegetation, grasses and shrubs
145	LM-102A	97°24'	27°19'	371.3	246.9	7.2	-	Apr. '47 - Mar. '48	Apr. '70 - June '70	3 cabins 2 piers	Typical, low, halophytic vegetation
146	LM-103	97°24'	27°19'	265.8	218.5	1.0	-	Apr. '47 - Mar. '48	July '72 - Nov. '72	3 cabins on pilings 3 piers	Low vegetation, herbs, and grasses
147	LM-105	97°24'	27°18'	296.6	210.5	4.2	3.4	Apr. '47 - Mar. '48	July '72 - Nov. '72	1 cabin 1 pier	Herbs and grasses on higher ground - Halophytes on perimeter
148	LM-107	97°24'	27°18'	313.3	138.5	3.2	-	Apr. '47 - Mar. '48	July '72 - Nov. '72	1 cabin 1 outhouse 1 shower	*Baptisia leucophaea, Borrichia f., Typha d.*
149	LM-109	97°24'	27°18'	270.9	229.2	2.6	2.3	Apr. '47 - Mar. '48	July '72 - Nov. '72	3 stucco & 2 tin buildings, 1 pier	*Baptisia l., Nerium O., Typha d., Prosopis g., Borrichia f.* on high ground - halophytes
150	LM-111	97°24'	27°18'	237.4	170.7	3.4	2.7	Apr. '47 - Mar. '48	July '72 - Nov. '72	2 piers 3 cabins 1 pavilion	Low halophytes on perimeter, grasses and herbaceous shrubs on higher ground
151	LM-113-115	97°24'	27°17'	218.5	161.5	2.8	-	Jan. '48 - Dec. '51	July '72 - Nov. '72	6 cabins 4 piers	Typical, low, halophytic vegetation
152	LM-117	97°24'	27°17'	153.9	57.0	0.5	-	Jan. '48 - Dec. '51	July '72 - Nov. '72	2 cabins 1 pier	Typical, low, halophytic vegetation
153	LM-135	97°25'	27°15'	228.0	85.7	0.7	-	Jan. '48 - Dec. '51	June '74 - Nov. '74	1 cabin 1 pier	Typical, low, halophytic vegetation

APPENDIX D: PLANT SPECIES COLLECTED FROM ISLANDS IN THE SOUTHERN AREA

TYPHACEAE

Typha domingensis Pers.
Tule

GRAMINEAE

Andropogon glomeratus (Walt.) B.S.P.
Bushy Beardgrass
Aristida intermedia Scribn. & Ball.
Prairie Three-awn
Bothriochloa Ischaemum (L.) Keng. var. *songaricus* Fisch. & Mey.
King Ranch Bluestem
Bothriochloa saccharoides (Sw.) Rybd.
Silver Bluestem
Cenchrus ciliaris
Buffelgrass
Cenchrus incertus M.A. Curtis
Coast Sandbur
Chloris cucullata Bisch.
Hooded Windmill Grass
Chloris latisquamea Nash.
Nash Windmill Grass
Chloris petraea Sw.
Stiffleaf Chloris
Cynodon Dactylon (L.) Pers.
Bermuda Grass
Digitaria texana Hitchc.
Texas Crabgrass
Distichlis spicata (L.) Greene.
Saltgrass
Echinochloa crusgalli (L.) Beauv.
Barnyard Grass
Eragrostis Barrelieri Daveau.
Mediterranean Lovegrass
Eragrostis oxylepis (Torr.) Torr.
Red Lovegrass
Eragrostis sessilispica Buckl.
Tumble Lovegrass
Eragrostis spectabilis (Pursh.) Steud.
Purple Lovegrass
Leptoloma cognatum (Schult.) Chase.
Fall Witchgrass
Monanthochlöe littoralis Engelm.
Shoregrass

(Continued)

GRAMINEAE (Continued)

Panicum angustifolium Ell.
Narrow-leaf Panicum
Panicum ovinum Scribn. & Sm.
Sheep Panicum
Panicum sphaerocarpon Ell.
Roundseed Panicum
Paspalum dilatatum Poir.
Dallis Grass
Paspalum monostachyum Vasey.
Gulfdune Paspalum
Paspalum setaceum Michx.
Thin Paspalum
Paspalum vaginatum Sw.
Seashore Paspalum
Polypogon monspeliensis (L.) Desf.
Rabbitfoot Grass
Setaria leucopila (Scribn. & Mey.) K. Schum.
Plains Bristlegrass
Spartina patens (Ait.) Muhl.
Saltmeadow Cordgrass
Spartina spartinae (Trin.) Hitchc.
Sacahuista, Gulf Cordgrass
Sporobolus asper (Mich
Tall Dropseed
Sporobolus cryptandrus (Torr.) Gray.
Sand Dropseed
Sporobolus pyramidatus (Lam.) Hitchc.
Whorled Dropseed
Sporobolus virginicus (L.) Kunth.
Coastal Dropseed
Stenotaphrum secundatum (Walt.) O. Ktze.
St. Augustine Grass
Tridens albescens (Vasey.) Woot. & Standl.
White Tridens
Uniola paniculata L.
Sea Oats

CYPERACEAE

Cyperus esculentus L.
Yellow Nut-grass
Cyperus ovularis (Michx.) Torr.
Globe Flatsedge
Cyperus rotundus L.
Nut-grass
Cyperus uniflorus T. & H.
Oneflower Flatsedge

(Continued)

CYPERACEAE (Continued)

Dichromena colorata (L.) Hitchc.
White-topped Umbrella Grass
Eleocharis montevidensis Kunth.
Sand Spikesedge
Fimbristylis castanea (Michx.) Vahl.
Fimbry
Scirpus americanus Pers.
American Bulrush

PALMAE

Phoenix canariensis Chab.
Ornamental Date Palm
Washingtonia robusta
Mexican Windmill Palm

COMMELINACEAE

Commelina erecta L.
Dayflower

LILIACEAE

Yucca aloifolia L.
Aloe Yucca
Yucca pendula
- - - - -
Yucca Treculeana Carr.
Spanish Dagger

AMARYLLIDACEAE

Agave americana L.
Century Plant
Agave americana var. *marginata* (Trel.)
Marginated Century
Aloe vera
True Aloe

IRIDACEAE

Sisyrinchium biforme Bickn.
Wiry Blue-eye Grass

ORCHIDACEAE

Spiranthes vernalis Engelm. & Gray.
Spring Ladies' Tresses

SALICACEAE

Salix nigra Marsh.
Black Willow

(Continued)

CASUARINACEAE

Casuarina equisetaefolia Forst.
Horsetail Beefwood

ULMACEAE

Celtis pallida Torr.
Granjeno, Desert Hackberry

URTICACEAE

Parietaria pensylvanica Muhl.
Hammerwort

POLYGONACEAE

Rumex pulcher L.
Fiddle Dock

CHENOPODIACEAE

Atriplex arenaria Nutt.
Quelite, Saltbrush
Salicornia Bigelovii Torr.
Bigelow Glasswort
Salicornia virginica L.
Virginia Glasswort
Suaeda linearis (Ell.) Moq.
Annual Seepweed

AMARANTHACEAE

Amaranthus Berlandieri (Moq.) Uline. & Bray.
Berlandier Amaranth
Amaranthus Palmeri Wats.
Palmer Amaranth
Philoxerus vermicularis (L.) R. Br.
Silverhead

BATACEAE

Batis maritima L.
Saltwort

AIZOACEAE

Sesuvium Portulac...
Sea Purslane

PORTULACACEAE

Portulaca mundula I.M. Johnst.
Chisme
Portulaca oleracea L.
Purslane

(Continued)

CARYOPHYLLACEAE

Silene Antirrhina L.
Sleepy Catchfly
Spergularia platensis (St.-Hill. & A. Juss.) Fenzl.
- - - - -
Spergularia marina (L.) Griseb.
Salt-marsh Sand-spurrey

CRUCIFERAE

Cakile fusiformis Greene.
Sea Rocket
Lepidium virginicum L.
Virginia Pepperweed
Rorippa teres (Michx.) Stuckey.
Yellow Cress

LEGUMINOSAE

Acacia Smallii Isely.
Texas Huisache
Astragalus leptocarpus T. & G.
Slimpod Milkvetch
Baptisia leucophaea var. *laevicaulis* Canby.
Plains Wild Indigo
Cassia fasciculata Michx.
Partridge Pea
Dalea emarginata (T. & G.) Shinners.
- - - - -
Dalea nana Torr.
Dwarf Dalea
Desmanthus obtusus Wats.
Bluntpod Bundleflower
Erythrina herbacea L.
Coral Bean
Indigofera minata Ort.
Scarlet Pea
Leucaena leucocephala (Lam.) de Wit.
Popinac
Leucaena pulverulenta (Schlecht.) Benth.
Tepeguaje
Medicago polymorpha L.
Bur-clover
Melilotus albus Lam.
White Sweet Clover
Melilotus officinalis (L.) Lam.
Yellow Sweet Clover
Neptunia pubescens Benth.
Tropical Neptu[illegible]

(Continued)

LEGUMINOSAE (Continued)

Prosopis glandulosa Torr.
Honey Mesquite
Psoralea rhombifolia T. & G.
Roundleaf Scurfpea
Rhynchosia americana (Mill.) C. Metz.
American Snoutbean
Rhynchosia texana T. & G.
Texas Snoutbean
Schrankia latidens (Small.) K. Schum.
Karnes Sensitivebriar
Sophora tomentosa L.
Yellow Sophora
Stylosanthes viscosa Sw.
- - - - -
Vicia Leavenworthii T. & G.
Leavenworth Vetch

LINACEAE

Linum alatum (Small.) Winkl.
Flax

MELIACEAE

Melia Azedarach L.
Chinaberry-tree

POLYGALACEAE

Polygala alba Nutt.
White Milkwort

EUPHORBIACEAE

Acalypha radians Torr.
Round Copperleaf
Croton punctatus Jacq.
Hierba del Jabali, Beach-tea
Euphorbia maculata L.
Spotted Euphorbia
Euphorbia serpens H.B.K.
Spurge
Phyllanthus polygonoides Spreng.
Knotweed Leafflower
Sapium sebiferum (L.) Roxb.
Chinese Tallow Tree

VITACEAE

Cissus incisa (Nutt.) Des Moul.
Marine-ivy, Ivy

(Continued)

MALVACEAE

Callirhoë involucrata (Torr.) Gray.
Low Poppymallow
Sida ciliaris L. var. *mexicana* (Moric.) Shinners.
- - - - -
Sida Lindheimeri Engelm. & Gray.
Showy Sida

TAMARICACEAE

Tamarix ramosissima Ledeb.
Salt Cedar

CACTACEAE

Echinocactus texensis Höpffer
Horse Crippler, Devil's Head
Mammillaria gummifera Engelm. var. *hemisphaerica* (Engelm.) L. Benson
Nipple Head
Opuntia leptocaulis DC.
Desert Christmas Cactus
Opuntia Lindheimeri Engelm.
Texas Prickly Pear

ONAGRACEAE

Calylophus australis Towner & Raven
- - - - -
Oenothera Drummondii Hook.
Beach Evening Primrose
Oenothera laciniata Hill.
Cut-leaved Evening Primrose
Oenothera speciosa Nutt.
Amapola del Campo, Showy Primrose

UMBELLIFERAE

Apium leptophyllum (Pers.) F. v. Muell.
Slimlobe Celery
Hydrocotyle bonariensis Lam.
Sombrerillo, Floating Pennywort
Limnosciadium pumilum (Engelm. & Gray.) Math. & Const.
- - - - -

PRIMULACEAE

Samolus ebracteatus H.B.K.
Coast Brookweed

PLUMBAGINACEAE

Limonium Nashii Small
Sea Lavender

(Continued)

GENTIANACEAE

Eustoma exaltatum (L.) G. Don.
Tall Prairie-gentian
Sabatia arenicola Greenm.
Sand Rose-gentian

APOCYNACEAE

Nerium Oleander L.
Common Oleander

ASCLEPIADACEAE

Asclepias oenotheroides Cham. & Schlecht.
Milkweed

CONVOLVULACEAE
CONVOLVULACEAE

Cuscuta pentagona Engelm.
Field Dodder
Ipomoea sagittata Poir.
Saltmarsh Morning Glory
Ipomoea stolonifera (Cyr.) Gmel.
Beach Morning Glory

POLEMONIACEAE

Phlox glabriflora (Brand.) Whiteh.
Rio Grande Phlox

BORAGINACEAE

Heliotropium curassavicum L.
Seaside Heliotrope

AVICENNIACEAE

Avicennia germinans (L.) L.
Black-mangrove

VERBENACEAE

Lantana Camara L.
West Indian Lantana
Phyla incisa Small.
Texas Frog-fruit
Phyla nodiflora (L.) Greene.
Common Frog-fruit
Verbena Halei Small.
Texas Vervain

LABIATAE

Monarda punctata
Spotted Beebalm

(Continued)

LABIATAE (Continued)

Scutellaria Drummondii Benth.
Drummond Skullcap
Scutellaria mariculata Ept.
- - - - -
Teucrium cubense [illegible]
Small Coast [illegible]

SOLANACEAE

Capsicum annuum L.
Bird Pepper, Chile Piquin
Lycium carolinianum Walt. var. *quadri[illegible]idum* (Dun.) C.L. Hitchc.
Carolina Wolfberry
Solanum americanum Mill.
American Nightshade
Solanum triquetrum Cav.
Texas Nightshade

SCROPHULARIACEAE

Agalinis maritima (Raf.) Raf.
Seaside Gerardia
Bacopa Monnieri (L.) Wettst.
Coastal Water-hyssop
Buchnera floridana Gand.
Florida Bluehearts
Maurandya antirrhiniflora Willd.
Snapdragon Vine
Stemodia tomentosa (Mill.) Greenm. & Thomps.
Woolly Stemodia

PLANTAGINACEAE

Plantago Hookeriana Fisch. & Mey.
Tallow Weed
Plantago hybrida Bart.
- - - - -
Plantago rhodosperma Dcne.
Red-seeded Plantain

RUBIACEAE

Hedyotis nigricans (Lam.) Fosb.
Prairie Bluets
Hedyotis subviscosa (Gray.) Shinners.
Nodding Bluets

COMPOSITAE

Ambrosia psilostachya DC.
Western Ragweed

(Continued)

COMPOSITAE (Continued)

Aphanostephus Kidderi Blake.
Kidder Dose Daisy
Aphanostephus skirrhobasis (DC.) Trel.
Lazy Daisy
Aster spinosus Benth.
Mexican Devil-weed
Aster sublatus Michx. var. *ligulatus* Shinners.
- - - - -
Baccharis neglecta Britt.
Roosevelt Weed, New Deal Weed
Borrichia frutescens (L.) DC.
Sea Ox-eye Da[illegible]
Conyza canadensis ([illegible]
Horse-weed
Coreopsis cardaminaefolia (DC.) Nutt.
Manzanilla Silvestre
Coreopsis tinctoria Nutt.
Plains Coreopsis
Croptilon divaricatum (Nutt.) Raf.
Slender Goldenweed
Dyssodia tenuiloba (DC.) Robins.
Bristleleaf Dogweed
Erigeron myrionactis Small.
Corpus Christi Fleabane
Gaillardia pulchella Foug.
Indian Blanket, Firewheel
Gnaphalium falcatum Lam.
Cudweed
Gnaphalium pensilvanicum Willd.
Cudweed
Helianthus annuus L.
Common Sunflower, Mirasol
Helianthus argophyllus T. & G.
Silverleaf Sunflower
Heterotheca pilosa (Nutt.) Shinners.
Soft Goldaster
Heterotheca subaxillaris (Lam.) Britt. & Rusby.
Camphor Weed
Iva angustifolia DC.
Narrowleaf Sumpweed
Machaeranthera phyllocephala (DC.) Shinners.
Camphor Daisy
Palafoxia texana DC.
Texas Palafoxia
Pluchea purpurascens (Sw.) DC.
Canela

(Continued)

COMPOSITAE (Continued)

Ratibida peduncularis (T. & G.) Barnh.
Naked Prairie-coneflower
Rudbeckia hirta L. var. *pulcherrima* Farw.
Brown-eyed Susan
Senecio imparipinnatus Klatt.
Ragwort
Sonchus oleraceus L.
Common Sowthistle
Thelesperma filifolium (Hook.) Gray.
Green-thread

APPENDIX E: PLANT SPECIES COLLECTED FROM ISLANDS IN THE NORTHERN AREA

POLYPODIACEAE

Asplenium platyneuron (L.) D.C.Eat.
Ebony Spleenwort

GRAMINEAE

Andropogon glomeratus (Walt.) B.S.P.
Bushy Beardgrass
Arundo Donax L.
Giant Reed
Bothriochloa saccharoides (Sw.) Rydb.
Silver Bluestem
Bromus unioloides H.B.K.
Rescue Grass
Chloris petraea Sw.
Stiffleaf Chloris
Cynodon Dactylon (L.) Pers.
Bermuda Grass
Distichlis spicata (L.) Greene.
Saltgrass
Eragrostis oxylepis (Torr.) Torr.
Red Lovegrass
Hordeum pusillum Nutt.
Little Barley
Hordeum vulgare L.
Barley
Leptochloa virgata
Tropic Sprang
Monanthochloë littoralis Engelm.
Shoregrass
Panicum repens L.
Torpedograss
Parapholis incurva (L.) C.E. Hubb.
Sicklegrass
Paspalum plicatulum Michx.
Brownseed Paspalum
Paspalum vaginatum Sw.
Seashore Paspalum
Phalaris caroliniana Walt.
Carolina Canarygrass
Polypogon monspeliensis (L.) Desf.
Rabbitfoot Grass
Setaria geniculata (Lam.) Beauv.
Knotroot Bristlegrass

(Continued)

GRAMINEAE (Continued)

Spartina alterniflora Lois.
Smooth Cordgrass
Spartina patens (Ait.) Muhl.
Saltmeadow Cordgrass
Spartina spartinae (Trin.) Hitchc.
Sacahuista, Gulf Cordgrass
Sphenopholis obtusata (Michx.) Scribn.
Prairie Wedgescale
Sporobolus cryptandrus (Torr.) Gray.
Sand Dropseed
Sporobolus indicus (L.) R.Br.
Smutgrass
Sporobolus pyramidatus (Lam.) Hitchc.
Whorled Dropseed
Sporobolus virginicus (L.) Kunth.
Coastal Dropseed
Stenotaphrum secundatum (Walt.) O.Ktze.
St. Augustine Grass

CYPERACEAE

Cyperus ovularis (Michx.) Torr.
Globe Flatsedge
Cyperus polystachyos Rottb. var. *texensis* (Torr.) Fern.
Flatsedge
Eleocharis sp.
Spikerush
Fimbristylis castanea (Michx.) Vahl.
Fimbry
Scirpus americanus Pers.
American Bulrush

COMMELINACEAE

Commelina erecta L.
Dayflower
Tradescantia hirsutiflora Bush.
Hairy Flower Spiderwort

JUNCACEAE

Juncus bufonius L.
Toad-rush
Juncus marginatus Rostk.
Grassleaf Rush

LILIACEAE

Nothoscordum bivalve (L.) Britt.
Crow-poison

(Continued)

ORCHIDACEAE

Spiranthes vernalis Engelm. & Gray.
Spring Ladies' Tresses

SALICACEAE

Salix nigra Marsh.
Black Willow

FAGACEAE

Quercus virginiana Mill.
Live Oak

ULMACEAE

Celtis Lindheimeri Engelm.
Paloblanco, Lindheimer Hackberry

MORACEAE

Morus rubra L.
Red Mulberry

URTICACEAE

Parietaria pensylvanica Muhl.
Hammerwort
Urtica chamaedryoides Pursh.
Heartleaf Nettle

POLYGONACEAE

Persicaria punctata (Ell.) Small.
Water Smartweed
Persicaria setacea (Baldw.) Small.
- - - - -
Polygonum argyrocoleon Kunze.
Knotweed, Smartweed
Polygonum ramosissimum Michx.
Knotweed, Smartweed
Rumex crispus L.
Yellow Dock, Curly Dock
Rumex pulcher L.
Fiddle Dock

CHENOPODIACEAE

Atriplex arenaria Nutt.
Quelite, Saltbrush
Chenopodium albescens Small.
Pale Goosefoot
Chenopodium ambrosioides L.
Mexican Tea, Wormseed

(Continued)

CHENOPODIACEAE (Continued)

Salicornia Bigelovii Torr.
Bigelow Glasswort
Salicornia virginica L.
Virginia Glasswort
Suaeda linearis (Ell.) Moq.
Annual Seepweed

AMARANTHACEAE

Amaranthus Palmeri Wats.
Palmer Amaranth

BATACEAE

Batis maritima L.
Saltwort

PHYTOLACCACEAE

Phytolacca americana L.
Pokeweed, Pokeberry
Rivina humilis L.
Pigeon-berry

AIZOACEAE

Sesuvium Portulacastrum L.
Sea Purslane

PORTULACACEAE

Portulaca oleracea L.
Purslane

CARYOPHYLLACEAE

Cerastium brachypodum (Engelm.) Robins.
Mouse-ear
Silene Antirrhina L.
Sleepy Catchfly
Spergularia echinosperma Celak.
Sand-spurrey
Stellaria prostrata Baldw.
Prostrate Starwort

FUMARIACEAE

Corydalis micrantha (Engelm.) Gray.
Scrambled Eggs

CRUCIFERAE

Lepidium austrinum Small.
Southern Pepperweed

(Continued)

CRUCIFERAE (Continued)

Lepidium virginicum L.
Virginia Pepperweed

CAPPARIDACEAE

Polanisia dodecandra (L.) DC.
Clammy Weed

ROSACEAE

Rosa bracteata Wendl.
Macartney Rose
Rubus trivialis Michx.
Southern Dewberry

LEGUMINOSAE

Acacia Smallii Isely.
Texas Huisache
Desmanthus illinoensis (Michx.) Mac M.
Illinois Bundleflower
Desmanthus obtusus Wats.
Bluntpod Bundleflower
Desmanthus virgatus (L.) Willd.
Bundleflower
Medicago polymorpha L. var. *vulgaris* (Benth.) Shinners.
Bur-clover
Melilotus indicus (L.) All.
Sour Clover, Alfalfilla
Parkinsonia aculeata L.
Retama
Sesbania Drummondii (Rydb.) Cory.
Rattlebush, Poison Bean, Coffee Bean
Strophostyles helvola (L.) Ell.
Amberique Bean, Trailing Wildbean
Vicia Leavenworthii T. & G.
Leavenworth Vetch
Vicia ludoviciana Nutt.
Deer Pea Vetch
Vigna luteola (Jacq.) Benth.
\- - - - -

GERANIACEAE

Geranium carolinianum L.
Carolina Geranium
Geranium texanum (Trel.) Heller.
Texas Geranium

(Continued)

OXALIDACEAE

Oxalis Dillenii Jacq.
Wood-sorrel

RUTACEAE

Zanthoxylum Clava-Herculis L.
Pepperbark, Hercules-club, Prickly Ash

EUPHORBIACEAE

Croton capitatus Michx.
Hogwort, Woolly Croton
Euphorbia dentata Michx.
Spurge
Euphorbia glyptosperma Engelm.
Ridgeseed Euphorbia
Phyllanthus polygonoides Spreng.
Knotweed Leafflower

CALLITRICHACEAE

Callitriche heterophylla Pursh. (emend. Darby)
Larger Water Starwort

AQUIFOLIACEAE

Ilex vomitoria Ait.
Yaupon, Cassine

VITACEAE

Ampelopsis arborea (L.) Koehne.
Pepper-vine

MALVACEAE

Malvaviscus arboreus Cav.
Mallow
Modiola caroliniana (L.) G. Don.
Carolina Modiola
Sida rhombifolia L.
Arrowleaf Sida
Sida spinosa L.
Prickly Mallow

TAMARICACEAE

Tamarix africana Poir.
Athel
Tamarix chinesis Lour.
- - - - -
Tamarix gallica L.
Saltcedar
Tamarix ramosissima Ledeb.
- - - - -

(Continued)

CACTACEAE

Opuntia Lindheimeri Engelm.
Texas Prickly Pear

ONAGRACEAE

Gaura brachycarpa
Plains Gaura
Oenothera Drummondii Hook.
Beach Evening Primrose
Oenothera laciniata Hill.
Cut-leaved Evening Primrose
Oenothera speciosa Nutt.
Amapola del Campo, Showy Primrose

UMBELLIFERAE

Apium leptophyllum (Pers.) F.v. Muell.
Slimlobe Celery
Polytaenia Nuttallii D.C.
Prairie Parsley

PRIMULACEAE

Anagallis arvensis L.
Scarlet Pimpernel
Samolus ebracteatus H.B.K.
Coast Brookweed

PLUMBAGINACEAE

Limonium Nashii Small.
Sea Lavender

OLEACEAE

Forestiera angustifolia Torr.
Desert Olive

GENTIANACEAE

Eustoma exaltatum (L.) G. Don
Tall Prairie-gentian

APOCYNACEAE

Nerium Oleander L.
Common Oleander

ASCLEPIADACEAE

Cynanchum angustifolium Pers.
Swallow Wort

(Continued)

CONVOLVULACEAE

Calystegia sepium (L.) R.Br.
Hedge-bindweed
Cuscuta cuspidata Engelm.
Cusp Dodder
Dichondra carolinensis Michx.
Pony-foot
Ipomoea sagittata Poir.
Saltmarsh Morning Glory
Ipomoea trichocarpa Ell. var. *trichocarpa*
Sharppod Morning Glory

BORAGINACEAE

Heliotropium curassavicum L.
Seaside Heliotrope

VERBENACEAE

Lantana horrida H.B.K.
Texas Lantana
Phyla nodiflora (L.) Greene.
Common Frog-fruit
Verbena Halei Small.
Texas Vervain

LABIATAE

Monarda punctata L.
Spotted Beebalm, Horsemint
Scutellaria muriculata Epl.
Skullcap
Stachys crenata Raf.
Shade Betony
Teucrium canadense L.
American Germander, Wood Sage
Teucrium cubense Jacq.
Small Coast Germander

SOLANACEAE

Lycium carolinianum Walt.
Carolina Wolfberry
Physalis viscosa L.
Beach Ground Cherry
Solanum americanum Mill.
American Nightshade
Solanum triquetrum Cav.
Texas Nightshade

(Continued)

SCROPHULARIACEAE

Agalinis heterophylla (Nutt.) Small.
Prairie Agalinis
Bacopa Monnieri (L.) Wettst.
Coastal Water-hyssop

PLANTAGINACEAE

Plantago Hookeriana Fisch. & Mey.
Tallow Weed

RUBIACEAE

Diodia teres Walt.
Poor Joe, Rough Buttonweed
Galium Aparine L.
Catchweed [illegible]
Hedyotis humifusa Gray.
Mat Bluets
Hedyotis nigricans (Lam.) Fosb.
Prairie Bluets

CAPRIFOLIACEAE

Lonicera japonica Thunb.
Japanese Honeysuckle

VALERIANACEAE

Valerianella Mill.
Corn Salad

CUCURBITACEAE

Ibervillea tripartita (Naud.) Greene.
Globe-berry
Melothria pendula L.
Meloncito, Drooping Melonette

COMPOSITAE

Ambrosia psilostachya DC.
Western Ragweed
Ambrosia trifida L.
Giant Ragweed
Aster spinosus Benth.
Mexican Devil-weed
Aster tenuifolius L.
Saline Aster
Baccharis halimifolia L.
Sea-myrtle, Consumption-weed
Borrichia frutescens (L.) DC.
Sea Ox-eye Daisy

(Continued)

COMPOSITAE (Continued)

Centaurea americana Nutt.
Basket-flower, Thornless Thistle

Conyza canadensis (L.) Cronq.
Horse-weed

Gaillardia pulchella Foug.
Indian Blanket, Firewheel

Gnaphalium purpureum L.
Purple Cudweed

Helenium amarum (Raf.) Rock
Bitterweed

Helianthus debilis Nutt. subsp. *cucumerifolius* (T. & G.) Heiser.
Sunflower

Heterotheca subaxillaris (Lam.) Britt. & Rusby.
Camphor Weed

Iva frutescens L.
Bigleaf Sumpweed

Machaeranthera phyllocephala (DC.) Shinners.
Camphor Daisy

Pyrrhopappus carolinianus (Walt.) DC.
Carolina False Dandelion

Senecio imparipinnatus Klatt.
Groundsel

Sonchus asper (L.) Hill.
Achicoria Dulce, Prickly Sow Thistle

APPENDIX F: PHYSICAL CHARACTERISTICS AND OCCURRENCE OF PLANT SPECIES IN ALL QUADRATS ON EACH STUDY ISLAND

Cover Percentages: 1. covering less than 5 percent of the ground surface; 2. covering 5 to 25 percent; 3. covering 25 to 50 percent; 4. covering 50 to 75 percent; 5. covering 75 to 100 percent.

Height Classes: 1. less than 0.1 meter; 2. 0.1 to .5 meter; 3. .5 to 1 meter; 4. 1 to 2 meters; 5. 2 to 3 meters; 6. 3 to 5 meters; 7. 5 to 10 meters; 8. 10 to 20 meters.

Abundance: U-Uncommon, I-Infrequent, A-Abundant, VA-Very Abundant.

Island LM 15A - 195 Quadrats

Species	% Cover 1	2	3	4	5	[illegible] 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	24	24	9	5		5	50	7						62	32	VA
[illegible]														0		
Bothriochloa saccharoides	12	23	25	4		2	57	5						64	33	VA
Cenchrus incertus														0		U
Chloris petraea	21	47	15			9	74							83	43	VA
Eragrostis oxylepis	9	8	3	2		2	20							22	11	A
Monanthochloë littoralis		1	1				2							2	1	I
Panicum ovinum														0		U
Paspalum monostachyum	10	8	5				23							23	12	A
Spartina patens														0		U
Spartina spartinae			1	1				2						2	1	I
Sporobolus virginicus	17	11	3	1	1	33								33	17	A
Uniola paniculata														0		U
Cyperus ocularis	3					3								3	2	I
Fimbristylis castanea	14	5	2				21							21	11	A
Commelina erecta	2					2								2	1	I
Sisyrinchium biforme	4						4							4	2	I
Spiranthes vernalis														0		U
[illegible]letaria pensylvanica														0		U
Atriplex arenaria	1	1					2							2	1	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Salicornia Bigelovii	8	1				5	4							9	5	I
Salicornia virginica														0		U
Suaeda linearis	5	3	1			8	1							9	5	I
Philoxerus vermicularis	1	1				2								2	1	I
Batis maritima	3					3								3	2	I
Sesuvium Portulacastrum														0		U
Portulaca mundula														0		U
Spergularia marina														0		U
Spergularia platensis	3	1				1	3							4	2	I
Cakile fusiformis	1						1							1	1	U
Lepidium virginicum	32					19	13							32	16	A
Astragalus leptocarpus	2	1				2	1							3	2	I
Baptisia leucophaea	5	4	4	1			14							14	8	I
Cassia fasciculata														0		U
Dalea emarginata	60	18				48	30							78	40	VA
Erythrina herbacea														0		U
Indigofera miniata	8													8	4	I
Neptunia pubescens														0		U
[illegible]	1		2				1		2					3	2	I
Psoralea rhombifolia														0		U
Rhynchosia texana														0		U
Stylosanthes viscosa														0		U
Linum alatum	3					3								3	2	I
Euphorbia maculata														0		U
Euphorbia serpens	1	2				3								3	2	I
Opuntia Lindheimeri	6	9	5			2	12	8						22	11	A
Calylophus australis	5	2				2	5							7	4	I
Oenothera Drummondii	6					1	5							6	3	I
Oenothera speciosa	1					1								1	1	U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Samolus ebracteatus	7					6	1							7	4	I
Limonium Nashii	10					5	5							10	5	I
Eustoma exaltatum														0		U
Cuscuta pentagona														0		U
Avicennia germinans														0		U
Phyla incisa	2					2								2	1	I
Scutellaria Drummondii	6					6								6	3	I
Lycium carolinianum	3	2					3	2						5	3	I
Solanum americanum	2	1				3								3	2	I
Maurandya antirrhiniflora														0		U
Plantago Hookeriana	28	2	2			30	2							32	16	A
Plantago rhodosperma	2	3				5								5	3	I
Hedyotis nigricans	36	9				38	7							45	23	A
Ambrosia psilostachya	39	13				12	40							52	27	A
Aphanostephus skirrhobasis														0		U
Baccharis neglecta				2					2					2	1	I
Borrichia frutescens	12	7					19							19	10	A
Erigeron myrionactis	12	4				16								16	8	I
Gaillardia pulchella	10	4	1			11	4							15	8	I
Helianthus annuus														0		U
Helianthus argophyllus														0		U
Heterotheca subaxillaris	26	48	6			28	52							80	41	VA
Iva angustifolia	35	14												53	27	A
Machaeranthera phyllocephala	5													5	3	I
Palafoxia texana														0		U
[illegible]urascens														0		
Thelesperma filifolium	4	2				1	5							6	3	I

APPENDIX F (Continued)

Island LM 35A - 126 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abu
Andropogon glomeratus	2						2							2	1	
Bothriochloa saccharoides	9	7				1	6	9						16	13	
Chloris petraea	38	9	2			14	35							49	39	
Monanthochloe littoralis	1	1				1		1						1	1	
Paspalum monostachyum	4	6	2	1			11	2						13	10	
Paspalum setaceum	2					2								2	1	
Paspalum vaginatum														0		
Spartina spartinae	1							1						1	1	
Sporobolus asper	19	2				5	16							21	17	
Sporobolus pyramidatus	3	1	4	1		8	1							9	7	
Sporobolus virginicus	7	20	13	2	2	2	42							44	35	
Cyperus ocularis		1					1							1	1	
Dichromena colorata														0		
Eleocharis montevidensis														0		
Fimbristylis castanea	4						4							4	3	
Aloe Vera														0		
Atriplex arenaria	5					2	3							5	4	
Salicornia Bigelovii	8	3				7	4							11	9	
Salicornia virginica	10	4	1				15							15	12	
Suaeda linearis	5	1				5	1							6	5	
Philoxerus vermicularis	2					2								2	1	
Batis maritima	2					1	1							2	1	
Sesuvium Portulacastrum	2					2								2	1	
Portulaca mundula	5													5	4	
Cakile fusiformis														0		
Lepidium virginicum														0		
[illegible]														0		

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundan
Baptisia leucophaea	4	4					8							8	6	I
Cassia fasciculata														0		U
Dalea emarginata	19					19								19	15	A
Indigofera miniata	14	6				9	14							23	18	A
Leucaena leucocephala	4	4	4		1	2	5	4	2					13	10	A
Croton punctatus	1					1								1	1	U
Euphorbia maculata														0		U
Tamarix ramosissima		1							1					1	1	U
Opuntia Lindheimeri		1						1						1	1	U
Calylophus australis	16	28	3			14	33							47	37	VA
Oenothera Drummondii	7	2				2	7							9	7	I
Samolus ebracteatus	17	13				19	11							30	24	A
Limonium Nashii	5	4				5	4							9	7	I
Eustoma exaltatum	3					2	1							3	[illegible]	I
Asclepias oenotheroides	1					1								1	1	U
Cuscuta pentagona														0		U
Heliotropium curassavicum	9	1				10								10	8	I
Phyla incisa	1	2				3								3	[illegible]	I
Lycium carolinianum	7	2				2	7							9	7	I
Stemodia tomentosa														0		U
Plantago Hookeriana	3					3								3	[illegible]	I
Plantago sp.	12	2				14								14	11	A
[illegible] nigricans	47	6				45	8							53	42	VA
Ambrosia psilostachya	24	8				12	20							32	25	A
Aphanostephus skirrhobasis														0		U
Borrichia frutescens	12	17												33	26	A
Erigeron myrionactis	7													7	6	I
Gaillardia pulchella	2	1				1	2							3	2	I
														0		

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Heterotheca subaxillaris	21	14				19	16							35	28	A
Iva angustifolia	26	6				6	26							32	25	A
Machaeranthera phyllocephala	10	14												26	21	A
Senecio imparipinnatus														0		U
Sonchus oleraceus	1					1								1	1	U
[illegible]sperma filifolium	20	3				15	8							23	18	

Island IM 39A - 149 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Typha domingensis														0		U
Andropogon glomeratus	2	2	3	1			4	2	2					8	5	I
Aristida intermedia	3	7	5					14	1					15	10	A
Bothriochloa saccharoides														0		U
Cenchrus incertus	1						1							1	1	U
Chloris petraea	3						3							3	2	I
Eragrostis oxylepis	7	7	1			5	9	1						15	10	A
Leptoloma cognatum	2	4					5	1						6	4	I
Monanthochloë littoralis	2					2								2	1	I
Panicum sphaerocarpon														0		U
Paspalum monostachyum	2	2					4							4	3	I
Paspalum setaceum	3	1				1	3							4	3	I
Spartina spartinae	1	1			1		1	2						3	2	I
Sporobolus asper	29	10	1			7	33							40	27	A
Sporobolus pyramidatus	16	30	11	5	5	10	56	1						67	45	VA
Sporobolus virginicus	5	15	13	4	3		40							40	27	A
Cyperus ovularis	1		1				2							2	1	I
Eleocharis montevidensis														0		U
Fimbristylis castanea	9	8	1				18							18	12	A
Spiranthes vernalis	2						2							2	1	I

APPENDIX F (Continued)

Species	% Cover					Height								Occurrences in Quadrats	% Occurrence in all Quadrats	Abundanc
	1	2	3	4	5	1	2	3	4	5	6	7	8			
Atriplex arenaria														0		U
Salicornia Bigelovii	5	5				4	6							10	7	I
Salicornia virginica	6	2	3			5	6							11	7	I
Suaeda linearis	3	4	1			4	4							8	5	I
Philoxerus vermicularis	1					1								1	1	U
Batis maritima	2					2								2	1	I
Sesuvium Portulacastrum	4	1				4	1							5	3	I
Lepidium virginicum	1						1							1	1	U
Dalea emarginata	31					28	3							31	21	A
Indigofera miniata														0		U
Medicago polymorpha														0		U
Prosopis glandulosa														0		U
Psoralea rhombifolia	2					1	1							2	1	[illegible]
Schrankia latidens														0		U
Sophora tomentosa														0		U
Euphorbia maculata	1						1							1	1	U
Opuntia leptocaulis														0		U
Calylophus australis	1						1							1	1	U
Oenothera Drummondii	28	16	2	1	2	13	33	3						49	33	VA
Samolus ebracteatus	5	5				10								10	7	I
Limonium Nashii	7	6				7	6							13	9	I
Eustoma exaltatum	1						1							1	1	U
Cuscuta pentagona														0		U
[illegible] incisa														0		U
Verbena Halei														0		U
Lycium carolinianum	10					1	8	1						10	7	I
Agalinis maritima	1					1								1	1	U
Bacopa Monnieri	3	1	1			2	3							5	3	I
Buchnera floridana														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Plantago Hookeriana	1													1	1	U
Hedyotis nigricans	27	21	14											67	45	VA
Ambrosia psilostachya	19	9	1			14	14	1						29	19	A
Aphanostephus skirrhobasis	3	1				2	2							4	3	I
Baccharis neglecta														0		U
Borrichia frutescens	17	12	7			1	31	4						36	24	A
Erigeron myrionactis	7	14	1			14	8							22	15	A
Gaillardia pulchella	4	1				2	3							5	3	I
Gnaphalium sp.														0		U
Heterotheca subaxillaris	20	14	2			16	20							36	24	A
Iva angustifolia	8					2	6							8	5	I
Machaeranthera phyllocephala	7	8				4	11							15	10	A
Pluchea purpurascens														0		U
Sonchus oleraceus														0		U
Thelesperma filifolium														0		U

Island LM 43 - 305 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	3	31	11	2										47	15	A
Cenchrus incertus	39	3				42								42	14	A
Chloris petraea	13	3				5	11							16	5	I
Distichlis spicata	5					3	2							5	2	I
Eragrostis oxylepis														0		U
Monanthochloë littoralis	1													1	<1	U
Panicum sphaerocarpon	1					1								1	<1	U
Paspalum monostachyum	19	39	13	2		2	71							73	24	A
Paspalum setaceum	2					2								2	<1	I
Spartina patens	3		3				6							6	2	I
Sporobolus asper	70	41	4			28	87							115	38	VA

APPENDIX F (Continued)

Species	% Cover					Height								Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
	1	2	3	4	5	1	2	3	4	5	6	7	8			
Sporobolus virginicus	42	20	3			7	58							65	21	A
Fimbristylis castanea	20	22	12	4	1		56	3						59	19	A
Scirpus americanus	4						3	1						4	1	I
Spiranthes vernalis	1						1							1	<1	U
Atriplex arenaria														0		U
Salicornia Bigelovii	28		2			21	9							30	10	A
Salicornia virginica	5	6				5	6							11	4	I
Suaeda linearis	24	11				27	8							35	11	A
Batis maritima		2												2	<1	I
Sesuvium Portulacastrum	11													11	4	I
Cakile fusiformis	1					1								1	<1	U
Baptisia leucophaea		3	1				4							4	1	
Dalea emarginata	42	1				34	9							43	14	A
Indigofera miniata	33	6				30	9							39	13	A
Medicago polymorpha														0		U
Prosopis glandulosa	1						1							1	<1	U
Psoralea rhombifolia														0		U
Schrankia latidens	1					1								1	<1	U
Sophora tomentosa														0		U
Linum alatum	4					4								4	1	I
Euphorbia serpens	1					1								1	<1	U
Tamarix ramosissima	1	2	1				4							4	1	I
Opuntia Lindheimeri	1					1								1	<1	U
Oenothera Drummondii	83	6	1			54	36							90	30	VA
Hydrocotyle bonariensis	4	1				4	1							5	2	I
Samolus ebracteatus	30	11				[illegible]	[illegible]							41	13	A
Limonium Nashii	31	2				[illegible]	[illegible]							33	11	A
Eustoma exaltatum	7	1				4	4							8	3	I
Sabatia arenicola	30		2			27	5							32	10	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Verbena Halei														0		U
Lycium carolinianum	4	1					5							5	2	I
Stemodia tomentosa		1					1							1	<1	U
Plantago Hookeriana	2					2								2	<1	I
Plantago rhodosperma	2	1				1	2							3	1	I
Hedyotis nigricans	20	9				27	2							29	10	A
Hedyotis subviscosa	4					4								4	1	I
Ambrosia psilostachya	22	8				4	26							30	10	A
Aphanostephus skirrhobasis	10	4				11	3							14	5	I
Baccharis neglecta														0		U
Borrichia frutescens	20	13				3	30							33	11	A
Conyza canadensis														0		U
Erigeron myrionactis	75	10				81	4							85	28	A
Gaillardia pulchella	19	5	1			15	10							25	8	I
Heterotheca subaxillaris	85	61	5			87	64							151	50	VA
Iva angustifolia	25	4				5	24							29	10	A
Machaeranthera phyllocephala	36	14												50	16	A
Thelesperma filifolium														0		U

Island LM 43A - 124 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	4	1					5							5	4	I
Aristida intermedia		2				2								2	2	I
Cenchrus incertus	15	3				17	1							18	14	A
Chloris petraea	2					1	1							2	2	I
Distichlis spicata	3						3							3	2	I
Eragrostis oxylepis														0		U
Panicum ovinum														0		U
Panicum sphaerocarpon	7						7							7	6	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Paspalum monostachyum	3	10	9	1			29							29	23	A
Paspalum setaceum	3					3								3	2	I
Spartina patens	4	1	3				4	4						8	6	I
Sporobolus asper														0		U
Sporobolus pyramidatus														0		U
Sporobolus virginicus	13	21	4				38							38	31	VA
Uniola paniculata														0		U
Unknown Grass #1	35	4				7	32							39	31	VA
Unknown Grass #2	35	3				38								38	31	VA
Cyperus ovularis	4	6					4	3						10	8	I
Fimbristylis castanea	4	7	4	1			14	2						16	13	A
Commelina erecta	2					2								2	2	I
Sisyrinchium biforme	1						1							1	1	U
Salix nigra														0		U
Salicornia Bigelovii														0		U
Salicornia virginica	1	1	1			1	2							3	2	I
Suaeda linearis	2	3	1			3	3							6	5	I
Philoxerus vermicularis														0		U
Batis maritima	1					1								1	1	U
Sesuvium Portulacastrum	2	1				3								3	2	I
Cakile fusiformis	1					1								1	1	U
Baptisia leucophaea														0		U
Dalea emarginata	23	3				19	7							26	21	A
Indigofera miniata	18	2	2			17	5							22	18	A
Sophora tomentosa														0		U
Linum alatum	5													5	4	I
Croton punctatus	6	4				5	5							10	8	I
Euphorbia maculata														0		U
Tamarix ramosissima														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Calylophus australis														0		U
Oenothera Drummondii	47	2				42	7							49	40	VA
Samolus ebracteatus	12					7	5							12	10	A
Limonium Nashii	7					7								7	6	I
Eustoma exaltatum	6					2	4							6	5	I
Sabatia arenicola	14					14								14	11	A
Avicennia germinans	1						1							1	1	U
Phyla incisa	1						1							1	1	U
Lycium carolinianum	3	2					5							5	4	I
Buchnera floridana														0		U
Hedyotis nigricans	15	7				18	4							22	18	A
Ambrosia psilostachya	1	4					5							5	4	I
Aphanostephus skirrhobasis	2					2								2	2	I
Borrichia frutescens	8	4	1			2	10	1						13	10	A
Erigeron myrionactis	14	7				21								21	17	A
Gaillardia pulchella	4						4							4	3	I
Heterotheca subaxillaris	32	46	5			41	42							83	67	VA
Iva angustifolia	17	6				4	19							23	18	A
Machaeranthera phyllocephala	7	4	1			5	7							12	10	A
Island LM 47 - 132 Quadrats																
Chloris petraea	2					1	1							2	2	I
Distichlis spicata														0		U
Echinochloa crusgalli														0		U
Paspalum monostachyum	5	2												7	5	I
Paspalum setaceum														0		U
Paspalum vaginatum														0		
Spartina patens														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Sporobolus asper	18					18								18	14	A
Sporobolus virginicus	4	3	1				8							8	6	I
Cyperus esculentus														0		U
Cyperus ovularis	2					1	1							2	2	I
Fimbristylis castanea	1						1							1	1	
Commelina erecta	2					1	1							2	2	I
Rumex pulcher														0		U
Atriplex arenaria														0		U
Salicornia Bigelovii	3					3								3	2	I
Salicornia virginica														0		U
Suaeda linearis	8	1				7	2							9	7	I
Amaranthus Berlandieri														0		U
Amaranthus Palmeri														0		U
Batis maritima														0		U
Sesuvium Portulacastrum	3	2				3	2							5	4	I
Cakile fusiformis	2					1	1							2	2	I
Dalea emarginata	5	2				7								7	5	I
Indigofera miniata														0		U
Croton punctatus	1					1								1	1	U
Euphorbia maculata														0		U
Tamarix ramosissima	1	1	[illegible]											3	2	I
Opuntia Lindheimeri														0		U
Oenothera Drummondii	18					18								18	14	A
Samolus ebracteatus	2	1				1	2							3	2	
Limonium Nashii														0		U
Lycium carolinianum	2					1	1							2	2	I
Hedyotis nigricans	20	4				23	1							24	18	A
Ambrosia psilostachya		5	1			1	5							6	4	I
Borrichia frutescens	3	1					4							4	3	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Erigeron myrionactis	1	2				1	2							3	2	I
Gaillardia pulchella	2	1				3								3	2	I
Heterotheca subaxillaris	10	1				11								11	8	I
Machaeranthera phyllocephala	7	2				7	2							9	7	I
Thelesperma filifolium														0		U
Island LM 47.5 - 157 Quadrats																
Typha domingensis														0		U
Andropogon glomeratus	7	14				1	16	4						21	13	A
Aristida intermedia														0		U
Bothriochloa saccharoides														0		U
Cenchrus incertus	19	6				23	2							25	16	A
Chloris petraea	8	1				6	3							9	6	I
Monanthochloë littoralis	1	1					2							2	1	I
Panicum sp.	1						1							1	1	U
Paspalum monostachyum	10	39	7			1	54	1						56	36	VA
Paspalum setaceum	7					7								7	4	I
Sporobolus asper	28	2				14	16							30	19	A
Sporobolus cryptandrus	22					21	1							22	14	A
Sporobolus pyramidatus	2					2								2	1	I
Sporobolus virginicus	22	15	2	1	1	4	36	1						41	26	A
Cyperus ovularis	2						2							2	1	I
Cyperus uniflorus														0		U
Eleocharis montevidensis														0		U
Fimbristylis castanea	8	8	2			2	16							18	11	A
Commelina erecta	9					3	6							9	6	I
Salicornia Bigelovii	3		3											6	4	I
Salicornia virginica	5	3	[illegible]											10	6	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Suaeda linearis	5	2	1	1		3	6							9	6	I
Batis maritima	1					1								1	1	U
Sesuvium Portulacastrum	2					2								2	1	I
Cakile fusiformis	1					1								1	1	U
Baptisia leucophaea														0		U
Dalea emarginata	31	15				23	23							46	29	A
Indigofera miniata	22	3				22	2	1						25	16	A
Neptunia pubescens	1					1								1	1	U
Prosopis glandulosa														0		U
Rhynchosia americana														0		U
Schrankia latidens	3					3								3	2	I
Sophora tomentosa														0		U
Linum alatum	19					15	4							19	12	A
Croton punctatus	3					2	1							3	2	I
Tamarix ramosissima														0		U
Opuntia Lindheimeri														0		U
Oenothera Drummondii	26	7				22	11							33	21	A
Hydrocotyle bonariensis														0		U
Samolus ebracteatus	30	22				28	24							52	33	VA
Limonium Nashii	7					7								7	4	I
Eustoma exaltatum	10					9	1							10	6	I
Sabatia arenicola	6					6								6	4	I
Phyla incisa	1	1					2							2	1	I
Lycium carolinianum	7	4				4	7							11	7	I
Agalinis maritima														0		U
Plantago sp.	25	1												26	17	A
Hedyotis nigricans	42	34												76	48	VA
Ambrosia psilostachya	10	3				2	11							13	8	[illegible]
[illegible]	17	6				23								23	15	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Borrichia frutescens	14	6				3	16	1						20	13	A
Coreopsis sp.														0		U
Erigeron myrionactis	8					5	3							8	5	I
Gaillardia pulchella	25	11				28	[illegible]							36	23	A
Heterotheca subaxillaris	43	24				50	17							67	43	VA
Iva angustifolia	17	2				2	17							19	12	A
Machaeranthera phyllocephala	11	6				10	7							17	11	A
Pluchea purpurascens														0		U
Ratibida peduncularis	1					1								1	1	U
Thelesperma filifolium	17	1				9	9							18	11	A

Island LM 47A - 130 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	4		1			1	3	1						5	4	I
Bothriochloa saccharoides	1	4				1	4							5	4	I
Cenchrus incertus	13					13								13	10	A
Chloris petraea	12	4				6	10							16	12	A
Distichlis spicata		1					1							1	1	U
Monanthochloe littoralis	2	4				2	4							6	5	I
Paspalum monostachyum	10	20	11	2			43							43	33	VA
Paspalum setaceum	2					1	1							2	2	I
Sporobolus virginicus	46	23	2			11	60							71	55	VA
Stenotaphrum secundatum	1	1				2								2	2	I
Uniola paniculata														0		U
Cyperus ovularis	1						1							1	1	U
Fimbristylis castanea	6	4	1				11							11	8	I
Commelina erecta	10					3	7							10	8	I
Salicornia Bigelovii	11	6				6	11							17	13	A
Salicornia virginica	7	1				4	4							8	6	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Suaeda linearis	10	5	2			6	11							17	13	A
Batis maritima	3	2				1	4							5	4	I
Sesuvium Portulacastrum	5	1				5	1							6	5	I
Acacia Smallii														0		U
Baptisia leucophaea	1					1								1	1	U
Dalea emarginata	15					10	5							15	12	A
Indigofera miniata	36	5				34	7							41	32	VA
Neptunia pubescens														0		U
Rhynchosia americana	2					1	1							2	2	I
Schrankia latidens	2					2								2	2	I
Linum alatum	45	1												46	35	VA
Euphorbia serpens	1					1								1	1	U
Tamarix ramosissima	1						1							1	1	W
Opuntia Lindheimeri	1						1							1	1	U
Oenothera Drummondii	14	1				9	6							15	12	A
Hydrocotyle bonariensis														0		U
Samolus ebracteatus	25	5				17	13							30	23	A
Limonium Nashii	10	3				9	4							13	10	A
Eustoma exaltatum	4					2	2							4	3	I
Sabatia arenicola	4					3	1							4	3	I
Nerium Oleander														0		U
Cuscuta pentagona														0		U
Phyla incisa	6					5	1							6	5	I
Lycium carolinianum	2	5	1			2	5	1						8	6	I
Hedyotis nigricans	42	24				35	11							66	51	VA
Ambrosia psilostachya	14	8	2			3	21							24	18	A
Aphanostephus skirrhobasis	5	1				6								6	5	I
Borrichia frutescens	17	8	1			4	21	1						26	20	A
Conyza canadensis	1						1							1	1	U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Erigeron myrionactis	4	1												5	4	I
Gaillardia pulchella	29	1				[illegible]	[illegible]							30	23	A
Heterotheca pilosa														0		U
[illegible] subaxillaris	32	13				35	10							45	35	VA
Iva angustifolia	17	4				2	19							21	16	A
Machaeranthera phyllocephala	9	4				11	2							13	10	A
Pluchea purpurascens														0		U
Thelesperma filifolium	28	17				17	28							45	35	VA
Island LM 51 - 169 Quadrats																
Andropogon glomeratus	5	5				1	6	3						10	6	I
Cenchrus incertus	6	3				8	1							9	5	I
Chloris petraea	14		2			10	6							16	9	I
Cynodon Dactylon	3	1				1	3							4	2	I
Eragrostis oxylepis	2					2								2	1	I
Monanthochloë littoralis	1	1		1		1	2							3	2	I
Paspalum monostachyum	10	3		2	1		16							16	9	I
Paspalum setaceum	2					2								2	1	I
Sporobolus asper	26	10				16	19	1						36	21	A
Sporobolus cryptandrus	1	1				1	1							2	1	I
Sporobolus virginicus	11	24	2	5		5	37							42	25	A
Stenotaphrum secundatum		3	1	1		4	1							5	3	I
Cyperus esculentus														0		U
Cyperus uniflorus	5					2	3							5	3	I
Fimbristylis castanea	9	4	2				12	3						15	9	I
Washingtonia robusta														0		U
Commelina erecta	3						3							3	2	I
Salicornia Bigelovii	9					9								9	5	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Salicornia virginica	3	1				4								4	2	I
Suaeda linearis	8	4	1			11	1	1						13	8	I
Batis maritima	2	2				3	1							4	2	I
Sesuvium Portulacastrum	5	1				6								6	4	I
Lepidium virginicum	6					6								6	4	I
Acacia Smallii														0		U
Dalea emarginata	15	2				13	4							17	10	A
Dalea nana														0		U
Indigofera miniata	2													2	1	I
Medicago polymorpha														0		U
[illegible]	9					9								9	5	I
Melilotus officinalis														0		U
Prosopis glandulosa				1					1					1	1	U
Viola Leavenworthii														0		U
Linum alatum	1					1								1	1	U
Croton punctatus														0		U
Euphorbia maculata														0		U
Euphorbia serpens														0		U
Calylophus australis														0		U
Oenothera Drummondii	33	9				36	6							42	25	A
Hydrocotyle bonariensis	9					9								9	5	I
Samolus ebracteatus														0		U
Limonium Nashii	11	6				12	5							17	10	A
Eustoma exaltatum														0		U
Nerium Oleander														0		U
Ipomoea stolonifera														0		U
Phyla incisa	1					1								1	1	U
[illegible] carolinianum	10	1	2			4	8	1						13	8	I
Bacopa Monnieri														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Plantago sp.	2	1				2	1							3	2	I
Plantago Hookeriana	9					9								9	5	I
Hedyotis nigricans	20	18				26	12							38	22	A
Ambrosia psilostachya	19	8				14	12	1						27	16	A
Aphanostephus skirrhobasis	6					6								6	4	I
Borrichia frutescens	14	13			1	27	1							28	17	A
Coreopsis sp.	1					1								1	1	U
Erigeron myrionactis	21	1				22								22	13	A
Gaillardia pulchella	2	2				1	3							4	2	I
Heterotheca subaxillaris	2	4				3	3							6	4	I
Iva angustifolia														0		U
Machaeranthera phyllocephala	22	4	2			16	12							28	17	A
Palafoxia texana	1						1							1	1	I
Pluchea purpurascens														0		U
Ratibida peduncularis														0		U
Sonchus oleraceus	1													1	1	U
Thelesperma filifolium	[illegible]	[illegible]												4	2	I

Island LM 55 - 66 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus														0		U
Aristida intermedia	5	1				2	4							6	9	I
Anthrochloa saccharoides	2	2				2	2							4	6	I
Cenchrus ciliaris	5	4	1			2	8							10	15	A
Cenchrus incertus	3					3								3	4	I
Chloris latisquamea														0		U
Chloris petraea	11	2				6	7							13	20	A
Eragrostis spectabilis														0		U
Monanthochlöe littoralis	[illegible]		[illegible]	[illegible]	4	1	[illegible]		[illegible]					9	14	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundan
Paspalum dilatatum														0		U
Paspalum monostachyum		2	1				3							3	4	I
Paspalum setaceum	2					1	[illegible]							2	3	I
Spartina spartinae														0		U
Sporobolus cryptandrus	6	5				4	7							11	17	A
Sporobolus virginicus	2	4	2				8							8	12	A
Cyperus ovularis	3					3								3	4	I
Fimbristylis castanea														0		U
Commelina erecta														0		U
Atriplex arenaria														0		U
Salicornia Bigelovii	1	2	1		1	1	4							5	8	I
Salicornia virginica	4	6					10							10	15	A
Suaeda linearis	10	1				8	3							11	17	A
Batis maritima		1	1	3			5							5	8	I
Sesuvium Portulacastrum	2	1	1			3	1							4	6	I
Portulaca mundula														0		U
Spergularia marina	2	2				4								4	6	I
Spergularia platensis														0		U
Cakile fusiformis														0		U
Lepidium virginicum	26	3	1			21	9							30	45	VA
Baptisia leucophaea	1						1							1	2	U
Cassia fasciculata														0		U
Dalea emarginata														0		U
Indigofera miniata	12													12	18	A
Leucaena leucocephala		1	1					1	1					2	3	I
Neptunia pubescens														0		U
[illegible] glandulosa					2			2						2	3	I
Psoralea rhombifolia	2					2								2	3	I
Schrankia latidens	1					1								1	2	U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrence in Quadrats	% Occurrence in all Quadrats	Abundance
Euphorbia maculata	1	1				2								2	3	I
Euphorbia serpens														0		U
Phyllanthus polygonoides		1												1	2	U
Tamarix ramosissima														0		U
Opuntia leptocaulis														0		U
puntia Lindheimeri	4	3	6	1			11	2	1					14	21	A
Calylophus australis		1					1							1	2	U
Oenothera Drummondii	8	5				5	8							13	20	A
Samolus ebracteatus	2						2							2	3	I
Limonium Nashii	6	3				5	4							9	14	A
Eustoma exaltatum														0		U
Cuscuta pentagona														0		U
Verbena Halei	9	2				3	5	3						11	17	A
cutellaria sp.	1					1								1	2	U
ycium carolinianum	7	5	1			2	11							13	20	A
...num americanum	3					3								3	4	I
aurandya antirrhiniflora	1						1							1	2	U
Plantago Hookeriana	14	1				15								15	23	A
dyotis nigricans	16	5				20	1							21	32	VA
mbrosia psilostachya	11	15				8	18							26	39	VA
phanostephus skirrhobasis	2	2	2			5	1							6	9	I
accharis neglecta														0		U
rrichia frutescens	8	5	1				11	3						14	21	A
reopsis tinctoria	9	6	1			6	10							16	24	A
eptilon divaricatum														0		U
rigeron myrionactis	5	2				7								7	11	A
illardia pulchella	8	4	3			9	5							14	21	A
terotheca subaxillaris	12	8	4	1		12	13							25	38	VA
haeranthera phyllocephala	3					3								3	4	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Ratibida peduncularis	1	4	2			1	6							7	11	A
Thelesperma filifolium	1	3				1	3							4	6	I

Island LM 57 - 163 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	28	22	25				25	50						75	46	VA
Aristida intermedia	6					6								6	4	I
Bothriochloa saccharoides														0		U
Cenchrus ciliaris	2	1					3							3	2	I
Chloris petraea	17	2				14	5							19	12	A
Distichlis spicata	4		1	3		2	6							8	5	I
Monanthochloë littoralis	5	3	3	1	3	6	9							15	9	I
Panicum sphaerocarpon														0		U
Spartina patens														0		U
Sporobolus cryptandrus														0		U
Sporobolus virginicus	35	20	5			18	42							60	37	VA
Cyperus ovularis	1					1								1	1	U
Cyperus uniflorus	3					1	2							3	2	I
Fimbristylis castanea	5	6	2				13							13	8	I
Atriplex arenaria	2					2								2	1	I
Salicornia Bigelovii	12					12								12	7	I
Salicornia virginica	16	11	1	1		9	20							29	18	A
Suaeda linearis	17	5	1			13	10							23	14	A
Batis maritima		4	2			3	3							6	4	I
Sesuvium Portulacastrum	18	3				19	2							21	13	A
Portulaca mundula	1					1								1	1	U
Spergularia marina	5		2			7								7	4	I
Cakile fusiformis	4					1	3							4	2	I
Lepidium virginicum	36					27	9							36	22	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	Height 5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Baptisia leucophaea									0		U
Cassia fasciculata									0		U
Dalea emarginata									0		
gofera miniata									0		U
Prosopis glandulosa									0		U
Linum alatum	1				1				1	1	U
Croton punctatus									0		U
Euphorbia maculata									0		U
Tamarix ramosissima									0		U
Opuntia Lindheimeri									0		U
Calylophus australis		2			2				2	1	I
Oenothera Drummondii	15	4	6		17	8			25	15	A
Hydrocotyle bonariensis	8				8				8	5	I
Samolus ebracteatus	15	3			10	8			18	11	A
Limonium Nashii	18	12	4		20	14			34	21	A
Sabatia arenicola	11				9	2			11	7	I
Nerium Oleander									0		U
Asclepias oenotheroides									0		U
Cuscuta pentagona									0		U
ntana Camara									0		U
a incisa	2				2				2	1	I
rbena Halei	1				1				1	1	U
ium carolinianum	17	21	2		7	31	2		40	24	A
opa Monnieri									0		U
randya antirrhiniflora									0		U
ntago Hookeriana	6	1			7				7	4	I
yotis nigricans	17	7	2		22	4			26	16	A
rosia psilostachya	2				2				2	1	I
nostephus skirrhobasis	26	6			30	2			32	20	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Baccharis neglecta														0		U
Borrichia frutescens	40	15	8	3	2	10	54	4						68	42	VA
Coreopsis sp.	4					4								4	2	I
Erigeron myrionactis	56	19				34	41							75	46	VA
Gaillardia pulchella	4	2				4	2							6	4	I
Heterotheca subaxillaris	4					3	1							4	2	I
Machaeranthera phyllocephala	60	13												73	45	VA
Ratibida peduncularis	1													1	1	U
Sonchus oleraceus	1					1								1	1	U
Thelesperma filifolium														0		[illegible]

Island LM 57A - 197 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	4	3					5	2						7	4	I
Aristida intermedia														0		U
Cenchrus ciliaris	1					1								1	1	U
Cenchrus incertus														0		U
Chloris petraea	13	15				1	27							28	14	A
Eragrostis oxylepis														0		U
Eragrostis sessilispica		4					4							4	2	I
Monanthochloë littoralis	1	2	4	1	3		11							11	6	I
Paspalum monostachyum														0		U
Paspalum setaceum														0		U
Paspalum vaginatum														0		U
Spartina patens														0		U
Spartina spartinae														0		U
Sporobolus asper	16	22	18	1		4	53							57	29	A
Sporobolus cryptandrus														0		U
Sporobolus virginicus	32	24	9	3	2	21	49							70	36	VA

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Cyperus ovularis	1						1							1	1	U
Eleocharis montevidensis	2						2							2	1	I
Fimbristylis castanea	6	4					10							10	5	I
Phoenix canariensis														0		U
Rumex pulcher														0		U
Atriplex arenaria	2						2							2	1	I
Salicornia Bigelovii	12	5				9	8							17	9	I
Salicornia virginica	11	7	7			7	18							25	13	A
Suaeda linearis	28	3	3			28	6							34	17	A
Batis maritima	8	5				9	4							13	7	I
Sesuvium Portulacastrum	30	7	2			22	17							39	20	A
Spergularia marina	2	2				3	1							4	2	I
Spergularia platensis														0		U
Cakile fusiformis	7	2				3	6							9	4	I
Lepidium virginicum	48	30	1			[illegible]	[illegible]	[illegible]						79	40	VA
Baptisia leucophaea														0		U
Cassia fasciculata														0		U
Dalea emarginata														0		
Indigofera miniata														0		U
Leucaena leucocephala														0		U
Prosopis glandulosa														0		U
Psoralea rhombifolia	2					1	1							2	1	I
Croton punctatus														0		U
Euphorbia maculata														0		U
Phyllanthus polygonoides														0		U
Callirhoë involucrata														0		U
Tamarix ramosissima			1		1				2					2	1	I
Opuntia leptocaulis														0		U
Opuntia Lindheimeri														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Calylophus australis		1					1							1	1	U
Oenothera Drummondii	8	3	3			2	12							14	7	I
Apium leptophyllum	2					1	1							2	1	I
Hydrocotyle bonariensis	3	2	2	3	1	10	1							11	6	I
Limnosciadium pumilum														0		U
Samolus ebracteatus	1					1								1	1	U
Limonium Nashii	19	23	8			12	38							50	25	A
Cuscuta pentagona														0		U
Phyla incisa														0		U
Verbena Halei														0		U
Lycium carolinianum	19	14	4			3	34							37	25	A
Solanum americanum	16	7				11	10	2						23	12	A
Solanum triquetrum														0		U
Maurandya antirrhiniflora														0		U
Plantago Hookeriana	5	5	2			4	8							12	6	I
Plantago hybrida														0		U
Plantago rhodosperma														0		U
Hedyotis nigricans	1					1								1	1	U
Ambrosia psilostachya	17	18	7			4	37	1						42	21	A
Aphanostephus skirrhobasis	27	15				33	9							42	21	A
Aster spinosus		1	1					1	1					2	1	I
Baccharis neglecta														0		U
Borrichia frutescens	31	49	6	2	4	4	76	12						92	47	VA
Conyza canadensis	3	1												4	2	I
Coreopsis sp.	35	19	8		2	14	46	4						64	32	VA
Erigeron myrionactis	26	7	1			29	5							34	17	
Gaillardia pulchella	2	2	2				6							6	3	I
Helianthus annuus														0		U
Heterotheca subaxillaris														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Iva angustifolia														0		U
Machaeranthera phyllocephala	18	18	4	1		9	32							41	21	A
Pluchea purpurascens														0		U
Ratibida peduncularis														0		U
Sonchus oleraceus	20	3				12	7	4						23	12	A
Thelesperma filifolium														0		U

Island LM 63 - 41 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Distichlis spicata														0		U
Sporobolus pyramidatus	5	5				6	4							10	24	A
Atriplex arenaria														0		U
Salicornia Bigelovii	1					1								1	2	U
Salicornia virginica	1					1								1	2	U
Suaeda linearis	4					3	1							4	10	A
Batis maritima														0		U
Sesuvium Portulacastrum	7	6	2			15								15	37	VA
Portulaca mundula														0		U
Portulaca oleracea														0		U
Spergularia marina	1					1								1	2	U
Cakile fusiformis	2	4					6							6	15	A
Lepidium virginicum		1				1								1	2	U
Baptisia leucophaea														0		U
Cassia fasciculata														0		U
Oenothera Drummondii	8	2				9	1							10	24	A
Limonium Nashii	3					3								3	7	I
Heliotropium curassavicum														0		U
Lycium carolinianum	4	5	1			5	5							10	24	A
Solanum americanum														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Ambrosia psilostachya	1	4	5			2	8							10	24	A
Aphanostephus skirrhobasis														0		U
Borrichia frutescens	1	4	2				7							7	17	A
Gaillardia pulchella														0		U
Machaeranthera phyllocephala	6	1				4	3							7	17	A
Sonchus oleraceus														0		U
Island LM 81 - 75 Quadrats																
Cenchrus ciliaris														0		U
Cenchrus incertus		1				1								1	1	U
Chloris petraea	1	2					3							3	4	I
Cynodon Dactylon			1	1	2		4							4	5	I
Distichlis spicata														0		U
Eragrostis sp.														0		U
Paspalum vaginatum	1		1	1			2	1						3	4	I
Sporobolus sp.	8	12	3	2		10	15							25	33	VA
Cyperus ovularis														0		U
Parietaria pensylvanica														0		U
Atriplex arenaria														0		U
Salicornia Bigelovii	1					1								1	1	U
Salicornia virginica														0		U
Suaeda linearis	6					5	1							6	8	I
Batis maritima														0		U
Sesuvium Portulacastrum	5	5	2		2	12	1	1						14	19	A
Portulaca mundula														0		U
Spergularia marina	4	1	1			6								6	8	I
Cakile fusiformis														0		U
Lepidium virginicum	15	15	9	1		17	23							40	53	VA

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
[illegible]														0		U
Acalypha radians	1	3		1		4	1							5	7	I
Calylophus australis														0		U
Oenothera Drummondii														0		U
Oenothera speciosa														0		U
Limonium Nashii														0		U
Heliotropium curassavicum														0		U
Phyla incisa														0		U
Verbena Halei	1					1								1	1	U
Lycium carolinianum	11	5				5	11							16	21	A
Solanum americanum	15	13	2	1	1	15	16	1						32	43	VA
Plantago Hookeriana														0		U
Ambrosia psilostachya	11	7	1			7	12							19	25	A
Aphanostephus skirrhobasis	1					1								1	1	U
Aster spinosus														0		U
Aster subulatus	9	8	1		1	13	4	2						19	25	A
Baccharis neglecta	1	1		1	2	1	1			3				5	7	I
Borrichia frutescens	2	1		1		1	3							4	5	I
Conyza canadensis	11	4	2			16	1							17	23	A
Coreopsis tinctoria														0		U
Gaillardia pulchella	3	3	1			6	1							7	9	I
Gnaphalium sp.	3					3								3	4	I
Helianthus annuus														0		U
Pluchea purpurascens														0		U
Sonchus oleraceus	15					12	3							15	20	A
Thelesperma filifolium														0		U

APPENDIX F (Continued)

Island LM 105 - 160 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Typha domingensis														0		U
Andropogon glomeratus	2	2	1	1	1		3	4						7	4	I
Aristida intermedia														0		U
Bothriochloa Ischaemum	23	18	6											47	29	A
Cenchrus incertus	28	2												30	19	A
Chloris petraea	20	29	2			15	36							51	32	VA
[illegible]	1						1							1	1	U
Distichlis spicata														0		U
Eragrostis sessilispica		2	2				4							4	3	I
Monanthochloe littoralis														0		U
Paspalum monostachyum		1	1	2			4							4	3	I
Paspalum setaceum	9					9								9	6	I
Paspalum vaginatum		2	6	4	3	5	10							15	9	I
Polypogon monspeliensis	2						2							2	1	I
Spartina patens														0		U
Spartina spartinae														0		U
Sporobolus asper														0		U
Sporobolus cryptandrus	1						1							1	1	U
Sporobolus virginicus	8	19	8	1		5	25	6						36	22	A
Uniola paniculata														0		U
Cyperus ocularis	4					4								4	3	I
Eleocharis montevidensis														0		U
Commelina erecta														0		U
...syrinchium biforme	1					1								1	1	U
Atriplex arenaria	1						1							1	1	U
Salicornia Bigelovii	8	1				7	2							9	6	I
Salicornia virginica	7	5				2	10							12	8	I
Suaeda linearis	9	7				7	9							16	10	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Batis maritima	1		1			1	1							2	1	I
Sesuvium Portulacastrum	6	7	5	1		9	10							19	12	A
Portulaca mundula														0		U
Spergularia marina	9	9	4	1		12	11							23	14	A
Spergularia platensis														0		U
Lepidium virginicum	8	3				4	5	2						11	7	I
Baptisia leucophaea	3	9	3				14	1						15	9	I
Cassia fasciculata														0		U
Dalea emarginata	37	3				10	30							40	25	A
Indigofera miniata	1					1								1	1	U
Rhynchosia americana														0		U
Linum alatum	2						2							2	1	I
Polygala alba	5	1				1	5							6	4	I
Acalypha radians	2													2	1	I
Croton punctatus	1													1	1	U
Euphorbia serpens	15					15								15	9	I
polygonoides														0		U
Echinocactus texensis	1					1								1	1	U
Opuntia Lindheimeri														0		U
Calylophus australis	12						12							12	8	I
Oenothera Drummondii	28	14				21	21							42	26	A
Samolus ebracteatus	1						1							1	1	U
Limonium Nashii	4					2	2							4	3	I
Asclepias oenotheroides	31	5				31	5							36	22	A
Cuscuta pentagona														0		U
Ipomoea stolonifera														0		U
Phlox glabriflora														0		U
Phyla incisa	7					5	2							7	4	I
Lycium carolinianum	16	15	3		1	5	22	8						35	22	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abund.
Solanum texense	7	4				5	6							11	7	I
Hedyotis nigricans	29	33				54	8							62	39	VA
Ambrosia psilostachya	26	13	15			9	40	5						54	34	VA
Baccharis neglecta														0		
Borrichia frutescens	8	10	7	5	2	1	16	13	2					32	20	A
Dyssodia tenuiloba	6					2	4							6	4	I
Erigeron myrionactis	12	1				7	6							13	8	I
Gaillardia pulchella	24	9				9	24							33	21	A
Heterotheca subaxillaris	22	65				43	44							87	54	VA
Machaeranthera phyllocephala	1	1					2							2	1	I
Palafoxia texana	3						3							3	2	I
Pluchea purpurascens														0		U
Ratibida peduncularis														0		U
Sonchus oleraceus	1	3					1	3						4	3	I
Thelesperma filifolium	4					2	2							4	3	I

Island LM 109 - 131 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abund.
Andropogon glomeratus														0		U
Bothriochloa Ischaemum														0		U
Cenchrus ciliaris	1	4												22	17	A
Cenchrus incertus	1					1								1	1	U
Chloris cucullata	14	7	2	2		5	20							25	19	[illegible]
Chloris petraea		4				1	3							4	3	I
Distichlis spicata	3	12	4	1	3		21	2						23	18	A
Eragrostis Barrelieri														0		U
Eragrostis oxylepis														0		U
Monanthochlöe littoralis			5	2	7		14							14	11	A
Paspalum monostachyum	4		2			1	5							6	5	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Ab[illegible]
[illegible]														0		U
Sporobolus cryptandrus		3				3								3	2	I
Sporobolus pyramidatus														0		U
Sporobolus virginicus		21	14	5	3		43							43	33	VA
Cyperus ovularis														0		U
Cyperus rotundus	1						1							1	1	U
Fimbristylis castanea	13	4	[illegible]			[illegible]	1							19	15	A
Commelina erecta														0		U
Aloe vera														0		U
Salix nigra														0		U
Celtis pallida														0		U
Atriplex arenaria														0		U
Salicornia Bigelovii	1	3				4								4	3	I
Salicornia virginica	3	6				3	6							9	7	I
Suaeda linearis	10	2				5	7							12	9	I
Philoxerus vermicularis	4					4								4	3	I
Batis maritima	2	1				1	2							3	2	I
Sesuvium Portulacastrum	5	7	1	1		10	4							14	11	A
Portulaca mundula														0		U
Spergularia marina	9	3				12								12	9	I
Spergularia platensis														0		U
Cakile fusiformis	3	1					4							4	3	I
Lepidium virginicum	7					2	5							7	5	I
Baptisia leucophaea														0		U
Cassia fasciculata														0		U
Dalea emarginata	26	3				[illegible]								29	22	A
Indigofera miniata														0		U
Prosopis glandulosa														8	6	I
Psoralea rhombifolia	3	1				3	1							4	3	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Polygala alba														0		U
Acalypha radians	1						1							1	1	U
Croton punctatus	1						1							1	1	U
Euphorbia serpens	1	2				3								3	2	I
Phyllanthus polygonoides														0		U
Opuntia leptocaulis														0		U
Opuntia Lindheimeri														0		U
Oenothera Drummondii	5	1				2	4							6	5	[illegible]
Samolus ebracteatus	2					2								2	2	I
Limonium Nashii	14	1				10	5							15	11	A
Nerium Oleander														0		U
Asclepias oenotheroides	1					1								1	1	U
Cuscuta pentagona														0		U
Phlox glabiflora	1					1								1	1	U
Heliotropium curassavicum														0		U
Lantana Camara	1	2	1	1	2		2	2	3					7	5	I
Phyla incisa														0		U
Capsicum annuum			1				1							1	1	[illegible]
Lycium carolinianum	10	4	3			4	12	1						17	13	A
Solanum americanum	2						2							2	2	I
Plantago Hookeriana	2					2								2	2	[illegible]
Hedyotis nigricans	23	7	2			21	11							32	24	A
Ambrosia psilostachya	24	33	14	8		21	54	4						79	60	VA
Aphanostephus skirrhobasis														0		U
Baccharis neglecta														0		U
Borrichia frutescens	12	19	10	7			29	19						48	37	VA
Erigeron myrionactis	5	6				8	3							11	8	I
Gaillardia pulchella	2	4					6							6	5	I
Heterotheca sp.	11	19	21	17	4	27	45							72	55	VA

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Iva angustifolia		1					1							1	1	U
Machaeranthera phyllocephala	10	3	2			4	11							15	11	A
Pluchea purpurascens														0		U
Sonchus oleraceus	3					2	1							3	2	I
Thelesperma filifolium	6					3	3							6	5	I

Island LM 111 - 139 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	3	1	1		1	1	2	3						5	4	I
Aristida intermedia														0		U
Cenchrus incertus	9					[illegible]	[illegible]							9	6	I
Chloris petraea	30	14	1			[illegible]	[illegible]							45	32	VA
Digitaria texana														0		U
Distichlis spicata	13	15	9	1	3	3	28	10						41	32	VA
Eragrostis oxylepis														0		U
Monanthochlöe littoralis	1	1					2							2	1	I
Paspalum monostachyum			1				1							1	1	U
P… spalum setaceum														0		U
P… palum vaginatum														0		U
S… obolus asper	41	25	5			24	47							71	51	VA
… bolus cryptandrum														0		U
S… lus virginicus														0		U
… ularis	10					10								10	7	I
… ecta	11					11								11	8	[illegible]
… hes vernalis	2					2								2	1	I
Aloe …														0		U
Atripl… x arenaria	1						1							1	1	U
…licornia Bigelovii	2	1				1	2							3	2	I
…alicornia virginica	1						1							1	1	U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Suaeda linearis	2	1				2	1							3	2	I
Philoxerus vermicularis	5					5								5	4	I
Batis maritima														0		U
Sesuvium Portulacastrum	9													9	6	I
Portulaca mundula	2					2								2	1	I
[illegible]tensis	9					9								9	6	[illegible]
Cakile fusiformis	1						1							1	1	U
Lepidium virginicum	7					5	2							7	5	I
Astragalus leptocarpus														0		U
Baptisia leucophaea	4	5	4	3		3	10	3						16	12	A
Cassia fasciculata														0		U
Dalea emarginata	71	5				68	8							76	55	VA
Dalea nana	2					2								2	1	I
Indigofera miniata														0		U
Psoralea rhombifolia	19	3	1			23								23	17	A
Rhynchosia americana	4	1				5								5	4	I
Schrankia latidens														0		U
Polygala alba	11					5	6							11	8	I
Acalypha radians	8	6				14								14	10	A
Euphorbia serpens	25													25	18	A
Phyllanthus polygonoides	4					4								4	3	I
Sida ciliaris														0		[illegible]
[illegible] Lindheimeri														0		U
Calylophus australis	4		1				4	1						5	4	I
Oenothera Drummondii	16	6				14	8							22	16	A
Samolus ebracteatus	2	2				2	2							4	3	I
Limonium Nashii	3	1				2	2							4	3	I
Asclepias oenotheroides	5					5								5	4	I
Cuscuta pentagona														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Phlox glabriflora														0		U
Heliotropium curassavicum	1					1								1	1	U
Phyla incisa														0		U
Lycium carolinianum	24	2				8	15	3						26	19	A
Plantago Hookeriana	17					17								17	12	A
Hedyotis nigricans	20	47	17			64	20							84	60	VA
Ambrosia psilostachya	36	29												65	47	VA
Aphanostephus skirrhobasis														0		U
Baccharis neglecta														0		U
Borrichia frutescens	12	5	12	2	1	1	19	12						32	23	A
Erigeron myrionactis	13	1				14								14	10	A
Gaillardia pulchella	43	9	1			16	37							53	38	VA
Heterotheca subaxillaris	59	20	3			58	24							82	59	VA
Machaeranthera phyllocephala	11					6	5							11	8	I
Palafoxia texana	12	3				7	8							15	11	A
Pluchea purpurascens														0		U
Sonchus oleraceus	3					3								3	2	I
Thelesperma filifolium	7					7								7	5	I

Rollover Bay #1 (RB 1) - 75 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Bromus unioloides	3	4	1	3			1	10						11	15	A
Distichlis spicata	3	9	4		2		17	1						18	24	A
Phalaris caroliniana	2	1	1			1		3						4	5	I
Polypogon monspeliensis	2			1				3						3	4	I
Spartina alterniflora	8	6	6	8	8	4	21	11						36	48	VA
Spartina patens				1				1						1	1	U
Sporobolus virginicus	2	1			2	1	4							5	7	I
Salicornia Bigelovii	4						4							4	5	I

…ENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
…uda linearis	3	2				1	4							5	7	I
…atis maritima		1					1							1	1	U
…esuvium Portulacastrum	1					1								1	1	U
Geranium carolinianum	4						4							4	5	I
Opuntia Lindheimeri		1					1							1	1	U
Limonium Nashii	2	1					2	1						3	4	I
Cuscuta cuspidata	2							1	1					2	3	I
Lycium carolinianum		6	2	1	1		5	5						10	13	A
Baccharis halimifolia	2				1		1		2					3	4	I
Borrichia frutescens	2	4	4	1	3		4	10						14	19	A
Iva frutescens	2	2	2	1	2				6	3				9	12	A
Machaeranthera phyllocephala	1	3		2	3		6	3						9	12	A

Rollover Bay #2 (RB 2) - 25 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Bromus unioloides														0		U
…nodon Dactylon														0		U
…istichlis spicata			2	1	1	3		1						4	16	A
Hordeum vulgare				1				1						1	4	U
Panicum repens														0		U
…aspalum vaginatum														0		U
…halaris caroliniana			1					1						1	4	U
…olypogon monspeliensis		1					1							1	4	U
…partina alterniflora	2	4	2	1	4		7	6						13	52	VA
…porobolus cryptandrus														0		U
…robolus virginicus		2					2							2	8	I
…lygonum ramosissimum														0		U
…licornia Bigelovii	1					1								1	4	U
…uda linearis	4					3	1							4	16	A

APPENDIX F (Continued)

Species	% Cover					Height								Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
	1	2	3	4	5	1	2	3	4	5	6	7	8			
Amaranthus Palmeri														0		U
Batis maritima	1						1							1	4	U
Lepidium virginicum	1					1								1	4	U
Tamarix gallica		1			1				1	1				2	8	I
Opuntia Lindheimeri		1						1						1	4	U
Heliotropium curassavicum	1						1							1	4	U
Lycium carolinianum		1	3					3	1					4	16	A
Baccharis halimifolia			2		1					2	1			3	12	A
Borrichia frutescens	3	1	1	2	1		5	3						8	32	VA
Sonchus asper	1							1						1	4	U
Rollover Bay #4 (RB 4) - 37 Quadrats																
Bromus unioloides	1	4		1	1		1	6						7	19	A
Distichlis spicata		2	3		2	2	5							7	19	A
Spartina alterniflora	3		1		4			5	3					8	22	A
Spartina patens	1				1		1		1					2	5	I
Sporobolus virginicus	2	1	4			2	4	1						7	19	A
Parietaria pensylvanica	1	2	1				4							4	11	A
Salicornia virginica	1					1								1	3	U
Batis maritima	1					1								1	3	U
Lepidium virginicum	2	1				1	2							3	8	I
Sesbania Drummondii		1								1				1	3	U
Geranium texanum	1					1								1	3	U
Opuntia Lindheimeri	1		1	1	1			4						4	11	A
Cuscuta cuspidata	2							2						2	5	I
Heliotropium curassavicum	2					2								2	5	I
Lycium carolinianum	2	1		2	4		6	2	1					9	24	A
Ambrosia psilostachya	2							2						2	5	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Aster tenuifolius	3	3				2	4							6	16	A
Borrichia frutescens	1	1	2				1	2	1					4	11	A
Iva frutescens		3	6	6	5			1	15	4				20	54	VA

Trinity River Channel #2 (TRC 2) - 37 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Spartina spartinae	4	2	4		3		1	12						13	45	VA
Sporobolus indicus	1						1							1	3	U
Juncus sp.														0		U
Parietaria punctata														0		U
Desmanthus obtusus	1						1							1	3	U
Euphorbia glyptosperma	1		1			1	1							2	7	I
Tamarix gallica		3	1	1	5				2	8				10	34	VA
Opuntia lindheimeri		1						1						1	3	U
Gaura sp.	4	4	1				1	1	7					9	31	VA
Gaura brachycarpa	5	2	1				2	4	2					8	28	A
Samolus ebracteatus														0		U
Eustoma exaltatum	4						3	1						4	14	A
Cuscuta cuspidata	1								1					1	3	U
Heliotropium curassavicum		1					1							1	3	U
Baccharis halimifolia	1	5	3	3	8			4	14	2				20	69	VA
Borrichia frutescens	1							1						1	3	U
Gaillardia pulchella	3						3							3	10	A
Helenium amarum	2					1	1							2	7	I

Trinity River Channel #7 (TRC 7) - 24 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Distichlis spicata	1	1					1	1						2	8	I
Hordeum pusillum														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Spartina alterniflora	1	3					1	3						4	17	A
Spartina patens	3	1	2											8	33	VA
Spartina spartinae	2	1												13	54	VA
Sporobolus virginicus	2						2							2	8	I
Stenotaphrum secundatum	1						1							1	4	
Batis maritima	2						1	1						2	8	I
Acacia Smallii	2		1				2			1				3	13	A
Desmanthus virgatus														0		U
Melilotus indicus	2						2							2	8	I
Parkinsonia aculeata			1					1						1	4	U
Vicia Leavenworthii	1						1							1	4	U
Geranium carolinianum	1					1								1	4	U
Tamarix gallica	1			2						2	1			3	13	A
Opuntia Lindheimeri														0		U
Gaura sp.	3						2	1						3	13	A
Limonium Nashii	3						3							3	13	A
Nerium Oleander		1									1			1	4	U
Cynanchum angustifolium	2							2						2	[illegible]	I
Cuscuta cuspidata	8						4	3	1					8	33	VA
Heliotropium curassavicum	1					1								1	4	U
Phyla nodiflora														0		U
Verbena Halei														0		U
Scutellaria muriculata														0		U
Lycium carolinianum	12	6	.				5	11	2					18	75	VA
Galium Aparine			1						1					1	4	U
Ambrosia psilostachya	1		1				2							2	8	I
Aster tenuifolius	6	2					7	1						8	33	VA
Baccharis halimifolia		1								1				1	4	U
Borrichia frutescens	7	2					6	3						9	38	VA

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Gaillardia pulchella														0		U
Helianthus debilis	2					2								2	8	I
Iva frutescens	7	8	1			1	8	7						16	67	VA
Sonchus asper	1					1								1	4	U

Smith Point Island (TRC 10) - 68 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Distichlis spicata		1		1			2							2	3	I
Hordeum vulgare	1	1	1					1	2					3	4	I
Monanthochloë littoralis				1			1							1	1	U
Spartina patens				1	2			3						3	4	I
Sporobolus virginicus			2	1	1		2	2						4	6	I
Salicornia virginica					1		1							1	1	U
Portulaca oleracea			1			1								1	1	U
[illegible] virginicum	2						1	1						2	3	I
Polanisia dodecandra	4		1			2	2	1						5	7	I
Sesbania Drummondii					1				1					1	1	U
Euphorbia glyptosperma	1					1								1	1	U
Tamarix gallica					4					1	3			4	6	I
Opuntia Lindheimeri	6	4			1	1	6	4						11	16	I
Gaura brachycarpa	3	7	11	5	4	1	1	14	13	1				30	44	VA
Limonium Nashii	1						1							1	1	U
Cuscuta cuspidata	6	2	1	1			2		8					10	15	A
Ipomoea sagittata														0		U
Phyla nodiflora														0		U
Scutellaria muriculata	11	1				10	2							12	18	A
Lycium carolinianum	5	1					3	2	1					6	9	I
Diodia teres														0		U
Hedyotis humifusa														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abund
Ambrosia psilostachya	2	5	1				5	2	1					8	12	A
Aster spinosus		1			3				4					4	6	I
Baccharis halimifolia	2	[illegible]												14	21	A
Borrichia frutescens	6	1					[illegible]	5	1					7	10	A
Gaillardia pulchella		1				1								1	1	
[illegible] *subaxillaris*														0		U
Iva frutescens	4	4			2		1	9						10	15	A
Machaeranthera phyllocephala	3	1	2	3	4		4	9						13	19	A
Bulkhead Reef (BBC 76) - 68 Quadrats																
Arundo Donax	3							3						3	3	I
Distichlis spicata	12	15	4	5	13	18	22	9						49	41	VA
Spartina alterniflora		1						1						1	1	U
Spartina patens	5	7	5	1	18		5	30	1					36	30	VA
Spartina spartinae	1	1					2							2	2	I
Sporobolus virginicus														0		U
Parietaria pensylvanica	1					1								1	1	U
Willkommia Bigelovii	5	4				9								9	8	I
Suaeda linearis	3					3								3	3	I
Lepidium virginicum	5					4	1							5	4	I
Heliotropium indicum	23	6	1	1		16	15							31	26	A
Sesbania Drummondii		3		1	1				4	1				5	4	I
Geranium carolinianum	2					2								2	2	I
Cuscuta cuspidata	3							3						3	3	I
Heliotropium curassavicum	12					12								12	10	A
Lycium carolinianum	4						3	1						4	3	I
Agalinis heterophylla														0		U
Ambrosia psilostachya	4	2				4	1	1						6	5	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Baccharis halimifolia	3	4	2	3	6		1	6	9	2				18	15	A
Borrichia frutescens	10	4				1	9	4						14	12	A
Centaurea americana	3						3							3	3	I
Conyza canadensis	2	3	4	3	1		10	2						12	10	A
Iva frutescens	9	6	2			2	1	10	4					17	14	A
Machaeranthera phyllocephala	10	3		1	1	8	4	1	2					15	13	A

Atkinson Island South (HSC 88) - 137 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	16	11												27	20	A
Distichlis spicata	7	1				8								8	6	I
[illegible]														0		
Spartina patens	20	24	10	8	9	6	32	33						71	52	VA
Spartina spartinae	2			1			1	2						3	2	I
Cyperus polystachyos	2							2						2	1	I
Eleocharis sp.		1				1								1	1	U
Juncus bufonius	2	3	2			7								7	5	I
Salix nigra L.														0		[illegible]
Rumex crispus	1					1								1	1	U
Salicornia Bigelovii	7					7								7	5	I
Suaeda linearis	1					1								1	1	U
Sesuvium Portulacastrum	2					2								2	1	I
Lepidium virginicum	7					7								7	5	I
Acacia Smallii	1					1								1	1	U
Medicago polymorpha	1					1								1	1	U
Melilotus indicus	15	8	5	4	1									45	33	VA
Sesbania Drummondii	3	1	1	1										6	4	I
Viola ludoviciana	1					1								1	1	U
[illegible] carolinianum	4					4								4	3	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Tamarix africana	4	3		1			1	2	3	2				8	6	I
Opuntia lindheimeri	10	6				3	13							16	12	A
Gaura brachycarpa	26	44	16	4	10	6	74	20						100	73	VA
Oenothera laciniata	2					1	1							2	1	I
Oenothera speciosa	1					1								1	1	U
Anagallis arvensis	1					1								1	1	U
Cynanchum angustifolium	1						1							1	1	U
Cuscuta cuspidata	14					1	5	8						14	10	A
Phyla nodiflora	1					1								1	1	U
Teucrium cubense	14	2	1			3	14							17	12	A
Lycium carolinianum	2							1	1					8	1	I
Ambrosia psilostachya	14					10	4							14	10	A
Baccharis halimifolia	29	13	7	2	2		4	29	13	7				53	39	VA
Borrichia frutescens	30	11	3	5		5	17	27						49	36	VA
Conyza canadensis	9	10	3	4	2		14	14						28	20	A
Gaillardia pulchella	2													2	1	I
Heterotheca subaxillaris	17	7	2											26	19	A
Iva frutescens	8	4	2	1		6	2	2	4	1				15	11	A

Atkinson Island North (MBC 90) - 82 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Cynodon Dactylon	3					3								3	4	I
Distichlis spicata	5	1	1	1	12	3	13	4						20	24	A
Spartina patens	1		1		3		1	4						5	6	I
Juncus bufonius	2					2								2	2	I
Celtis lindheimeri		1	1	1	1					4				4	5	I
Parietaria pensylvanica														0		U
Persicaria setacea														0		U
Atriplex arenaria														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Chenopodium albescens	1					1								1	1	U
Salicornia Bigelovii	23	2		1		20	6							26	32	VA
Suaeda linearis	2					2								2	2	I
Lepidium virginicum	2						2							2	2	I
Rubus trivialis	2					2								2	2	I
Acacia Smallii	1	1					2							2	2	I
Melilotus indicus	31	2	4			18	19							37	45	VA
Parkinsonia aculeata		1			1					2				2	2	I
Sesbania Drummondii														0		U
Viola ludoviciana	3					1	2							3	4	I
Geranium carolinianum	3	5			1	5	3	1						9	11	A
Geranium texanum														0		U
Xanthoxylum Clava-Herculis	1	2	1	1	1				1	3	2			6	7	I
Callitriche heterophylla														0		U
Malvaviscus arboreus	1						1							1	1	U
Modiola caroliniana														0		U
Tamarix africana														0		U
Tamarix chinensis														0		U
Tamarix ramosissima														0		U
Opuntia Lindheimeri	10	5	1			2	9	6						16	20	A
Gaura brachycarpa	1	1					1	1						2	2	I
Oenothera Drummondii														0		U
Oenothera laciniata														0		U
Apium leptophyllum														0		U
Limonium Nashii	1						1							1	1	U
Cuscuta cuspidata	12	1					3	9	1					13	16	
Ipomoea sagittata														0		U
Heliotropium curassavicum	2					2								2	2	I
Lantana horrida	1							1						1	1	U

ENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
euarium cubense	3	[illegible]				[illegible]								5	6	I
ycium carolinianum	4		[illegible]											5	6	I
olanum americanum	5	1												6	7	I
lantago Hookeriana	2					2								2	2	I
[illegible]	2					1	1							2	2	I
edyotis humifusa	1					1								1	1	U
mbrosia psilostachya														0		U
accharis halimifolia	12	6	2	2	2	5	5	4	9	1				24	29	A
orrichia frutescens	19	8				1	13	13						27	33	VA
itaurea americana	21	4	3	1	8	7	18	13						38	46	VA
aillardia pulchella														0		U
lianthus debilis	[illegible]						[illegible]							1	1	U
frutescens	7	11	3	1	1		3	8	12					23	28	A
chaeranthera phyllocephala	13	1		2		13	2	1						16	20	A
us asper	2							1	[illegible]					2	2	I

Scott Bay #2 (HSC 116) - 125 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
odon Dactylon	20	1	1	1	2	24	1							25	20	A
enotaphrum secundatum	1					1								1	1	U
eocharis sp.	17	2				16	3							19	15	A
melina erecta														0		U
ex sp.	4					4								4	3	I
nopodium albescens	1					1								1	1	U
oornia Bigelovii	2	1				3								3	2	I
uvium Portulacastrum	7	1	8	1		17								17	14	A
dium virginicum	1					1								1	1	U
bracteata	7	2				[illegible]	7	1						9	7	I
ugo polymorpha	[illegible]					[illegible]								35	28	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Sesbania Drummondii	18					16	2							18	14	A
Geranium carolinianum	4		1			5								5	4	I
Oxalis Dillenii	1					1								1	1	U
Opuntia Lindheimeri	4					2	2							4	3	I
Limonium Nashii	2					2								2	2	I
Dichondra carolinensis	5					3	2							5	4	I
Heliotropium curassavicum														0		U
Teucrium cubense	6	6				3	9							12	10	A
Plantago Hookeriana														0		U
Galium Aparine	1													1	1	U
Baccharis halimifolia	24	[illegible]												30	24	A
Borrichia frutescens	7					7								7	6	I
Machaeranthera phyllocephala	19					19								19	15	

Scott Bay #3 (HSC 118) - 64 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus		1						1						1	2	U
Arundo Donax	1		2		4		1	1		5				7	11	A
Paspalum plicatulum														0		U
Spartina patens	1							1						1	2	U
Spartina spartinae	1		1					1	1					2	3	I
Cyperus ovularis														0		U
Cyperus polystachyos														0		U
leocharis sp.														0		U
irpus americanus														0		U
ommelina erecta														0		U
radescantia hirsutiflora	1													1	2	U
uncus bufonius	3	2												5	8	I
rietaria pensylvanica	2	2				3	1							4	6	I

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Persicaria setacea														0		U
Chenopodium albescens	3					3								3	5	I
Chenopodium ambrosioides														0		U
Sesuvium Portulacastrum		3		1		4								4	6	I
Lepidium austrinum	21	1				22								22	34	VA
Rosa bracteata	5	4	5	3	12	3	5	10	11					29	45	VA
Rubus trivialis	4	2				2	1	3						6	9	I
Sesbania Drummondii		1	1											2	3	I
Geranium carolinianum	2					[illegible]								2	3	I
Oxalis Dillenii	4	2				6								6	9	[illegible]
[illegible]-Herculis	1	2	1	3	2				3	4	2			9	14	A
Croton capitatus														0		U
Phyllanthus polygonoides														0		U
Ilex vomitoria			1							1				1	2	U
mpelopsis arborea	18	1				6	8	5						19	30	VA
Sida rhombifolia														0		U
Sida spinosa														0		U
puntia Lindheimeri	11	6	2	1	2	4	12	4	2					22	34	VA
nothera Drummondii														0		U
orestiera angustifolia				1	1				2					2	3	I
[illegible] horrida	2					2								2	3	I
marda punctata														0		U
uorium cubense	2						2							2	3	I
ysalis viscosa														0		U
ntago Hookeriana	17	1				18								18	28	A
odia teres														0		U
lothria pendula		2					2							2	3	I
charis halimifolia	3	2	5		1		3	3	4	1				11	17	A
[illegible] canadensis	17	1	5	1		19	4	1						24	38	VA

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abun[illegible]
Iva frutescens	1	2							2	1				3	5	
Machaeranthera phyllocephala	21	[illegible]				[illegible]								23	36	V[illegible]
[illegible]														0		
Andropogon glomeratus	4	8					4	8						12	5	[illegible]
Bothriochloa saccharoides	3	3		1			2	4	1					7	3	[illegible]
Chloris petraea														0		U
Cynodon Dactylon	2				2	2	1	1						4	2	I
Eragrostis oxylepis														0		U
Hordeum pusillum														0		U
Hordeum vulgare		1						1						1	>1	U
Leptochloa virgata														0		U
Monanthochloë littoralis	1					1								1	>1	U
Panicum repens	2					1	1							2	1	[illegible]
Phalaris caroliniana														0		U
Polypogon monspeliensis	6	3	3	2		2	3	9						14	9	[illegible]
Setaria geniculata	5					5								5	2	I
Spartina alterniflora	3	1												12	5	I
Spartina patens	3	2	[illegible]	[illegible]	[illegible]									40	27	A
Spartina spartinae	1		1					2						2	1	I
[illegible] *cryptandrus*														0		
Sporobolus pyramidatus		1			1		1	1						2	1	[illegible]
Sporobolus virginicus	7	6	4		3	1	12	7						20	9	[illegible]
Fimbristylis castanea	2							2						2	1	
Juncus marginatus														0		[illegible]
Spiranthes vernalis														0		[illegible]
Morus rubra														1	>1	

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Parietaria pensylvanica														0		U
Atriplex arenaria														0		U
Chenopodium albescens	7	1	1		1	2	4	4						10	4	I
Salicornia Bigelovii	1	2												3	1	I
Salicornia virginica	1	[illegible]												3	1	I
Suaeda linearis	[illegible]	[illegible]												77	33	VA
Batis maritima	1						1							1	<1	U
[illegible]														0		[illegible]
Lepidium virginicum	9	10	3	3	1	1	20	5						26	11	A
Melilotus indicus														0		U
Strophostyles helvola														0		U
Vigna luteola														0		U
Euphorbia glyptosperma														0		U
Opuntia Lindheimeri	2							2						2	1	I
Gaura brachycarpa	33	1	2				10	18	8					36	15	A
Oenothera Drummondii	1						1							1	<1	U
Eustoma exaltatum	1							1						1	<1	U
Cynanchum angustifolium	1							1						1	<1	U
Calystegia sepium														0		U
Cuscuta cuspidata	2							2						2	1	I
Ipomoea sagittata														0		U
Heliotropium curassavicum	24	6	5											37	16	A
Lycium carolinianum	11	6		[illegible]										24	10	A
Solanum americanum														0		U
[illegible]	1					1								1	<1	U
Lonicera japonica														0		U
Melothria pendula	11	2	3	2		5	6	5	2					18	8	I
Ambrosia psilostachya	10	3	3		1		1	16						17	7	I
Ambrosia trifida														0		U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abund[illegible]
Aster tenuifolius	28	10	[illegible]	[illegible]	[illegible]	6	41	20						67	29	A
Baccharis halimifolia	18	[illegible]												52	22	A
Borrichia frutescens	22	[illegible]												99	42	VA
Conyza canadensis	8	1				1	2	5	1					9	4	I
[illegible]														0		
Heterotheca subaxillaris														0		[illegible]
Iva frutescens		2					2							2	1	I
Machaeranthera phyllocephala	12	2	1	1	1	4	9	4						17	7	I
Pyrrhopappus carolinianus	1					1								1	<1	U

Jigsaw Island (WB 37) - 99 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abund[illegible]
Hordeum vulgare	2						1		1					2	2	I
Spartina alterniflora		1			2		2	1						3	3	I
Sporobolus virginicus	1		1			2								2	2	I
Rumex sp.		1					1							1	1	U
Chenopodium albescens	9	5	5	3	12	5	9	9	11					34	34	VA
Salicornia virginica	12	6	3	3	2	10	16							26	26	A
Suaeda linearis	16	9	2	2										31	31	VA
Batis maritima	2	3	1											6	6	I
Lepidium virginicum	4	1	1			1	2	3						6	6	I
[illegible]		3						3						3	3	
Limonium Nashii	1							1						1	1	U
Heliotropium curassavicum	4						4							4	4	I
Lycium carolinianum	4		1		3	2	1	5						8	8	I
Aster tenuifolius	5	3	2	1	1		3	8	1					22	12	A
Baccharis halimifolia		1							1					1	1	U
Borrichia frutescens		2		[illegible]	2		[illegible]	6						7	7	I
Iva frutescens	1													1	1	[illegible]
Machaeranthera phyllocephala	1					1								1	1	

APPENDIX F (Continued)

High Bank Island (WB 41) - 30 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Cynodon Dactylon	2	5	5	2	2	15	1							16	53	VA
Hordeum vulgare	5	3	15	4	2									29	97	VA
Medicago polymorpha	3	1				4								4	13	A
Viola Lanwenworthii	7	6	3	2		16	2							18	60	[illegible]
Galium Aparine	1					1								1	3	U
Ambrosia psilostachya														0		U
Borrichia frutescens		3			1		2	2						4	13	A
Helianthus debilis	2					2								2	7	I
Iva frutescens	1		1	1			1		2					3	10	A
Sonchus asper	1					1								1	3	U

Down North Deer Island (WB 43) - 50 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Distichlis spicata	5	3				6	2							8	16	A
Hordeum vulgare	5	4	1	3		5	6	2						13	26	A
Monanthochloe littoralis	2		1		2	5								5	10	A
Spartina alterniflora	1	1				2								2	4	I
Spartina spartinae				1				1						1	2	U
Sporobolus virginicus	1	3					1	3						4	8	I
Ortica chamaedryoides	1		1				1	1						2	4	I
Salicornia Bigelovii	2						2							2	4	I
Salicornia virginica	5	2				2	5							7	14	A
Suaeda linearis	1						1							1	2	U
Batis maritima	4	4	2	2			11	1						12	24	A
Sesuvium Portulacastrum	3		1			4								4	8	I
Lepidium virginicum	1						1							1	2	U
Medicago polymorpha	6	1				2	5							7	14	A
Opuntia Lindheimeri	1						1							1	2	U

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Limonium Nashii	2	2					1	3						4	8	I
Lycium carolinianum	3	14	8	5	3		[illegible]	[illegible]	4					33	66	VA
Galium Aparine	2	2	1											5	10	A
Ambrosia psilostachya	6	1	2				2	6	1					9	18	A
[illegible] halimifolia		3	3	7	2			3	12					15	30	VA
Borrichia frutescens	8	10	8	2	4		12	17	3					32	64	VA
Sonchus asper	5	1					6							6	12	A
West Bay 52 (WB 52) - 51 Quadrats																
Distichlis spicata		3					3							3	6	I
Hordeum vulgare	10	8	3	1	3		9	16						25	49	VA
Setaria geniculata		2						2						2	4	I
Spartina alterniflora	2	1	5	3			1	9	1					11	22	A
Spartina patens					1		1							1	2	U
Spartina spartinae	2	1	2		1			6						6	12	A
Urtica chamaedryoides	18	5	3	1	2		24	5						29	57	VA
Rumex crispus	1							1						1	2	U
Chenopodium albescens														0		U
Salicornia Bigelovii	2		2			1	3							4	8	I
Batis maritima	1	3				1	3							4	8	I
Phytolacca americana														0		U
Rivina humilis														0		U
Medicago polymorpha														0		U
Viola Leavenworthii	5						3	2						5	10	A
Geranium carolinianum	4				1		5							5	10	A
Opuntia Lindheimeri	3	2	7	2	2		2	12	3					17	34	VA
Limonium Nashii	2						2							2	4	I
Lantana horrida	1	2		2		3	2							5	10	A

APPENDIX F (Continued)

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Stachys arenata	1						1							1	2	U
Teucrium canadense														0		U
Lycium carolinianum	6	8	11	4	5		3	17	14					34	67	VA
Solanum americanum														0		U
Solanum triquetrum	3	1	2				1	3	2					6	12	A
Galium Aparine	11	7	3		2		19	4						23	45	VA
Ibervillea tripartita														0		U
Ambrosia psilostachya	3					3								3	6	I
Baccharis halimifolia	2	3	1	1	2				[illegible]	1				9	18	A
Borrichia frutescens	5	1				1	2	2	1					6	12	A
Iva frutescens		4	6	2	4			1	15					16	31	[illegible]
Sonchus asper	3						3							3	6	I

West Bay 52A (WB 52A) - 66 Quadrats

Species	% Cover 1	2	3	4	5	Height 1	2	3	4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Andropogon glomeratus	2						1	1						2	3	I
Distichlis spicata		1				1								1	1	U
Hordeum vulgare	4	7	5	3	1		8	11	2					20	30	VA
Leptochloa virgata														0		U
Monanthochloë littoralis	1					1								1	1	U
Setaria geniculata	2						2							2	3	I
Spartina alterniflora	2	10	5				12	5						17	26	A
Spartina patens		2		1	1			4						4	6	I
Spartina spartinae	3	2	1	5	2		4	9						13	20	A
Sporobolus virginicus	2	2				1	3							4	6	I
Nothoscordum bivalve														0		U
Quercus sp.		1							1					1	2	U
Parietaria pensylvanica														0		U
Urtica chamaedryoides	9	6	7	2			16	7	1					24	36	VA

APPENDIX F (Concluded)

Species	% Cover 1	2	3			Height 4	5	6	7	8	Occurrences in Quadrats	% Occurrence in all Quadrats	Abundance
Rumex sp.	3										3	5	I
Salicornia Bigelovii	6	7	1	1		5	10				15	23	A
Suaeda linearis	1					1					1	[illegible]	[illegible]
[illegible] maritima	6	7				2	11				13	20	A
Phytolacca americana	2	3					2	2	1		5	8	I
Sesuvium Portulacastrum	1					1					[illegible]	[illegible]	U
Stellaria prostrata											0		U
Corydalis micrantha											0		U
Lepidium virginicum	1							1			1	2	U
Desmanthus illinoensis											0		U
Medicago polymorpha	5	1				3	3				6	9	I
Viola Leavenworthii	10	3					13				13	20	A
Geranium carolinianum	2						2				2	3	I
Opuntia Lindheimeri	7	3					5	5			10	15	A
Gaura sp.	10						8	2			10	15	A
Polytaenia Nuttallii											0		U
Limonium Nashii	5	2				[illegible]	2				7	11	A
Ipomoea trichocarpa											0		U
Lantana horrida	3	3	3	6	1		12		4		16	24	A
Stachys arenata	1	1	2	1			3	1	1		5	8	[illegible]
Galium Aparine	3	4	2				8	1			9	14	A
Ambrosia psilostachya	12	10	1		1	2	17	5			24	36	VA
Baccharis halimifolia		3						1	2		3	5	I
Borrichia frutescens	7	6				2	5	6			13	20	A
Gaillardia pulchella		1					1				1	2	U
Iva frutescens	4	5	5	8			1	1	20		22	33	VA
Sonchus asper	6	1					[illegible]				7	11	A

APPENDIX G: BIRD SPECIES NESTING ON DREDGED MATERIAL ISLANDS IN THE TWO STUDY AREAS ON THE TEXAS COAST DURING 1977

1. The letters after the common name indicate the study area in which the bird nested; (S) - southern, (N) - northern, (B) - both.

PELECANIFORMES

Pelecanus erythrorhyncus Gmelin
White Pelican (S)
Pelecanus occidentalis Linnaeus
Brown Pelican (S)
Phalacrocorax olivaceus (Humboldt)
Olivaceus Cormorant (N)

ANSERIFORMES

Anas fulvigula Ridgway
Mottled Duck (S)

FALCONIFORMES

Falco sparverius Linnaeus
American Kestrel (S)

GALLIFORMES

Colinus virginianus (Linnaeus)
Bobwhite (S)

CICONIIFORMES

Ajaia ajaja (Linnaeus)
Roseate Spoonbill (N)
Ardea herodias Linnaeus
Great Blue Heron (B)
Bubulcus ibis Linnaeus
Cattle Egret (B)
Butorides virescens (Linnaeus)
Green Heron (N)
Casmerodius albus (Linnaeus)
Great Egret (B)
Dichromanassa rufescens (Gmelin)
Reddish Egret (B)
Egretta thula (Molina)
Snowy Egret (B)
Eudocimus albus (Linnaeus)
White Ibis (B)
Florida caerulea (Linnaeus)
Little Blue Heron (B)

(Continued)

CICONIIFORMES (Continued)

Hydranassa tricolor (Muller)
Louisiana Heron (B)
Ixobrychus exilis (Gmelin)
Least Bittern (N)
Nycticorax nycticorax (Linnaeus)
Black-crowned Night Heron (B)
Plegadis chihi (Vieillot)
White-faced Ibis (B)

GRUIFORMES

Rallus longirostris (Boddaert)
Clapper Rail (N)

CHARADRIIFORMES

Catoptrophorus semipalmatus (Gmelin)
Willet (B)
Charadrius vociferus Linnaeus
Killdeer (S)
Gelochelidon nilotica (Gmelin)
Gull-billed Tern (B)
Haematopus palliatus Temminck
American Oystercatcher (N)
Himantopus mexicanus (Muller)
Black-necked Stilt (B)
Larus atricilla Linnaeus
Laughing Gull (B)
Recurvirostra americana Gmelin
American Avocet (B)
Rynchops niger Linnaeus
Black Skimmer (B)
Sterna albifrons Pallas
Least Tern (B)
Sterna caspia (Pallas)
Caspian Tern (B)
Sterna forsteri Nuttall
Forster's Tern (B)
Sterna fuscata Linnaeus
Sooty Tern (S)
Sterna maxima (Boddaert)
Royal Tern (B)
Sterna sandvicensis (Latham)
Sandwich Tern (B)

COLUMBIFORMES

Columbina passerina Linnaeus
Ground Dove (S)

(Continued)

COLUMBIFORMES (Continued)

Zenaida macroura (Linnaeus)
Mourning Dove (S)

CUCULIFORMES

Coccyzus americanus (Linnaeus)
Yellow-billed Cuckoo (S)
Crotophaga sulcirostris Swainson
Groove-billed Ani (S)

CAPRIMULGIFORMES

Chordeiles minor (Forster)
Common Nighthawk (S)

PASSERIFORMES

Agelaius phoeniceus (Linnaeus)
Red-winged Blackbird (B)
Quiscalus mexicanus (Gmelin)
Great-tailed Grackle (B)
Lanius ludovicianus Linnaeus
Loggerhead Shrike (S)
Mimus polyglottis (Linnaeus)
Mockingbird (B)
Muscivora forficata (Gmelin)
Scissor-tailed Flycatcher (B)
Passer domesticus (Linnaeus)
House Sparrow (B)
Sturnella sp. Vieillot
Meadowlark (B)
Toxostoma rufum (Linnaeus)
Brown Thrasher (N)

APPENDIX H: NESTING INFORMATION ON BIRDS USING DREDGED MATERIAL ISLANDS ALONG THE COAST OF TEXAS

E - Early, M - Middle, L - Late, C - Colonial, S - Solitary, G - Ground, B - Bushes, T - Trees

AOU No.	Scientific Name	Common Name	Eggs No.	Eggs Avg.	Breeding	Type Nester	Where	Avg. Egg Size (mm)	Egg Color
125	*Pelecanus erythrorhynchos*	White Pelican	1-3	2	L. Apr.- Aug.	C	G	89.9 x 66.4	dull, chalk, white
126	*Pelecanus occidentalis*	Brown Pelican	2-5	2-3	Mar.- July	C	T,B,G	72.9 x 46.5	dull, chalk, white
121	*Phalacrocorax olivaceus*	Olivaceous Cormorant	3-5	4	L. Jan.- L. Oct.	C	T,B,G	54.1 x 33.6	green or blue white
194b	*Ardea herodias*	Great Blue Heron	3-4		L. Jan.- M. Aug.	C,S	T,B,G	65.3 x 46.3	pale greenish blue, niagara green, pale lichen green
201	*Butorides striatus*	Green Heron	3-9	4-5	E. Mar.- M. July	C,S	T,B	38.0 x 29.0	pale green or greenish blue
200	*Florida caerulea*	Little Blue Heron	2-9	4-5	Mar.- Aug.	C	T,B	43.9 x 33.5	pale greenish blue, niagara green, pale lichen green
200.1	*Bubulcus ibis*	Cattle Egret	2-5		Apr.- Sept.	C	T,B	44.9 x 33.0	pale blue, greenish blue
198	*Dichromanassa rufescens*	Reddish Egret	2-7	3-4	E. Mar.- L. July	C	T,B,G	51.1 x 37.8	green blue to pale green
196	*Casmerodius albus*	Great Egret	2-5	3-4	E. Mar.- L. July	C	T,B	56.4 x 40.4	pale blue, pale green blue, pale nigra green
197	*Egretta thula*	Snowy Egret	2-6	4-5	L. Mar.- Aug.	C	T,B	42.9 x 32.3	pale bluish green to pale green
199	*Hydranassa tricolor*	Louisiana Heron	2-7	4-5	L. Mar.- L. Aug.	C	T,B	43.9 x 32.3	pale greenish blue, niagara green, pale lichen green
202	*Nycticorax nycticorax*	Black-crowned Night Heron	1-8	3-5	E. Feb.- L. July	C	T,B,G	51.6 x 37.1	pale light blue green, green, blue white
203	*Nyctanassa violacea*	Yellow-crowned Night Heron	3-6	4	E. Mar.- M. July	C,S	T,B	51.3 x 36.8	pale green, blue glaucous green, pale olivine
191	*Ixobrychus exilis*	Least Bittern	3-7	4-5	E. Apr.- M. Aug.	S	T,B,G	31.0 x 23.5	bluish white, greenish white
188	*Mycteria americana*	Wood Ibis	2-5	3	June 12- July 24	C	T,B	67.8 x 46.0	chalky white, usually nest stain

APPENDIX H (Continued)

AOU No.	Scientific Name	Common Name	Eggs No.	Eggs Avg.	Breeding	Type Nester	Where	Avg. Egg Size (mm)	Egg Color
187	*Plegadis chihi*	White-faced Ibis	2-7	3-4	E. Apr.- L. July	C	B,G	51.6 x 36.1	deep green, blue green, nile blue
184	*Eudocimus albus*	White Ibis	3-5		Apr.- July	C	T,B	56.1 x 37.3	gray white to gray, shell spotted & blotched brown
183	*Ajaia ajaja*	Roseate Spoonbill	2-7	3-4	Apr.- July	C	B	65.0 x 43.7	dull cream color, pink white, green blue blotched brown
286	*Haematopus palliatus*	American Oystercatcher	2-4	2-3	E. Feb.- M. July	S	G	55.9 x 38.9	cream, brown or olive, buff blotched & spotted blue and brown
273	*Charadrius vociferus*	Killdeer	3-5	4	L. Feb.- E. Aug.	S	G	36.3 x 26.7	ivory yellow to cream to buff blotched
258	*Catoptrophorus semipalmatus*	Willet	3-8	4	L. Mar.- L. July	S	G	56.6 x 38.1	light blue gray, or olive buff marked clove brown or sepia
225	*Recurvirostra americana*	American Avocet	3-8	4	E. May- E. Aug.	S	G	49.8 x 34.0	olive buff spots of brown, shell marked with drab
226	*Himantopus mexicanus*	Black-necked Stilt	3-7	4	M. Apr.- M. Aug.	C,S	G	43.9 x 30.5	clay color, brown black spots
58	*Larus atricilla*	Laughing Gull	2-5	3	E. Apr.- L. July	C	G	53.6 x 38.6	olive to blue white spotted with marks of gray or lavender
63	*Gelochelidon nilotica*	Gull-billed Tern	1-4	2-3	E. Apr.- M. Aug.	C	G	47.0 x 34.0	buff, ivory yellow spotted brown with drab and dull violet
69	*Sterna forsteri*	Forster's Tern	2-6	3	E. Apr.- M. July	C	G	43.2 x 30.7	olive to cartridge buff spotted and blotched brown
75	*Sterna fuscata*	Sooty Tern	1-3	1	L. Apr.- E. July	C,S	G	50.0 x 35.1	cream color, buff or pinkish white with sparse shades of brown
74	*Sterna albifrons*	Least Tern	1-4	2-3	E. Apr.- E. Aug.	C	G	31.0 x 23.6	blue green, drab spotted brown
65	*Sterna maximus*	Royal Tern	1-4	1-2	Mar.- L. July	C	G	63.0 x 44.4	white dull yellow with dots of brown and black

APPENDIX H (Continued)

AOU No.	Scientific Name	Common Name	Eggs No.	Eggs Avg.	Breeding	Type Nester	Where	Avg. Egg Size (mm)	Egg Color
67	*Sterna sandvicensis*	Sandwich Tern	1-3	1-2	M. Apr.- M. July	C	G	51.5 x 36.1	white to olive buff marked with black and brown shades
64	*Sterna caspia*	Caspian Tern	1-4	2	M. Mar.- M. July	C	G	64.5 x 45.0	buff or green buff, spots of brown and gray
80	*Rynchops nigra*	Black Skimmer	3-7	4-5	M. Mar.- E. Sept.	C	G	45.0 x 33.5	white to pale green blue blotched & spotted with dark brown and black
316	*Zenaida macroura*	Mourning Dove	1-4	2	Mar.- Sept.	S	T,B,G	28.2 x 21.6	white
320	*Columbina passerina*	Ground Dove	2-3	2	M. Mar.- L. Oct.	S	G,B	21.9 x 16.3	pure white oval to ovate
134	*Anas fulvigula*	Mottled Duck	6-11	9	Apr.- Aug.	C	G	54.8 x 40.4	greenish white or cream white
360	*Falco sparverius*	American Kestrel	3-7	5	E. Mar.- E. Aug.	S	T	35.0 x 29.0	white, cream, buff, reddish cinnamon
289	*Colinus virginianus*	Bobwhite	9-33	10-15	Mar.- Aug.	S	G	29.9 x 23.9	dull white sometimes buff
210	*Rallus longirostris*	Clapper Rail	4-13	8-11	Apr.- June	S	G	41.9 x 29.2	clay or buff spotted or marked with gray or lavendar
387	*Coccyzus americanus*	Yellow-billed Cuckoo	2-8	3-4	Mar.- Sept.	S	B,T	30.2 x 22.9	nile blue, greenish blue sometimes washed with white
384	*Crotophaga sulcirostris*	Groove-billed Ant	3-6	3-5	May - Sept.	C,S	B,T	31.2 x 23.9	greenish blue covered with chalky deposit
420	*Chordeiles minor*	Common Nighthawk	1-3	2	L. Mar.- L. Aug.	S	G	29.9 x 21.9	white to olive gray blotched & spotted with black, olive, gray or brown
707	*Toxostoma curvirostre*	Curve-billed Thrasher	3-5	3	E. Mar.- L. Aug.	S	B	28.4 x 20.1	light green to deep blue to yellow blue green
622	*Lanius ludovicianus*	Loggerhead Shrike	4-6	5	Mar.- L. Aug.	S	B,T	24.6 x 18.5	gray to yellow to green with specks
498	*Agelaius phoeniceus*	Redwinged Blackbird			M. Apr.- L. July	C	B,T	24.6 x 17.5	olive white, blue green spotted with brown or purple

APPENDIX H (Concluded)

AOU No.	Scientific Name	Common Name	Eggs No.	Eggs Avg.	Breeding	Type Nester	Where	Avg. Egg Size (mm)	Egg Color
513	*Quiscalus mexicanus*	Great-tailed Grackle	3-5	4	Mar.- E. Aug.	C	B,T	32.0 x 21.6	blue and greenish gray spotted and marked with brown and black
703	*Mimus polyglottos*	Mockingbird	3-6	4	M. Feb.- L. Aug.	S	B,T	24.4 x 18.8	blue, blue green, green spotted with brown
443	*Muscivora forficata*	Scissor-tailed Flycatcher	3-6	4-5	L. Mar.- L. Aug.	S	T	22.6 x 17.C	white or white with brown spots
688	*Passer domesticus*	House Sparrow	4-9	5-6	E. Feb.- L. July	C	B,T	22.1 x 15.5	white to gray blotched with brown or gray
501	*Sturnella sp.*	Meadowlark	3-8	5	E. Mar.- L. Aug.	S	G	27.9 x 20.3	white or greenish white with brown or purple spots

APPENDIX I: NESTING INFORMATION ON COLONIAL BIRDS THAT NESTED ON DREDGED MATERIAL ISLANDS IN THE TWO STUDY AREAS ON THE TEXAS COAST DURING 1977

Island	Species	Colony No.	Total Nests	Nests Monitored	Total Eggs	Average eggs/nest	Eggs Hatched	Hatching Success %
LM 15A	Great Blue Heron	3,4,5,6,7	35	10	32	3.2	17	53.1
	Cattle Egret	7	30	Late Nesters				
	Snowy Egret	5,7	2	2	6	3.0	6	100.0
	Black-crowned Night Heron	4,6,7	7	7	21	3.0	14	66.7
	Great Egret	7	1	-	-	-	-	-
	Laughing Gull	2,8	80	10	27	2.7	3	1.1
	Gull-billed Tern	1	25	10	26	2.6	8	30.8
	Least Tern	1	1	1	1	1.0	-	-
	Black Skimmer	1	35	10	36	3.6	29	80.6
LM 43	Black Skimmer	1	17		No Eggs Found			
LM 43A	Gull-billed Tern	1	3	3	3	1.0	-	-
	Least Tern	1	2	2	4	2.0	-	-
	Black Skimmer	1	78	2	2	1.5	-	-
LM 47	Least Tern	1,2	16	3	3	1.0	-	-
LM 47.5	Least Tern	2	11	-	-	-	-	-
	Black Skimmer	1	10	-	-	-	-	-
LM 51	Least Tern	1	1	1	1	1.0	-	-
	Caspian Tern	2	1	1	2	2.0	2	100.0
	Black Skimmer	3	13	-	0	-	-	-
LM 55	White Pelican	1	120	10	19	1.9	-	-
	Great Blue Heron	1,2,3	32	10	-	-	15	-
	Cattle Egret	1,2,3	150	10	26	2.6	-	-
	Snowy Egret	1,2,3	10	10	-	-	-	-
	Black-crowned Night Heron	1,2	55	-	-	-	-	-
	Laughing Gull	4	6	6	16	2.6	-	-
LM 57	Laughing Gull	1	10	10	26	2.6	-	-
	Gull-billed Tern	4	22	10	12	1.2	3	25.0
	Royal Tern	2,3	52	10	11	1.1	-	-
	Sandwich Tern	2,3	434	10	12	1.2	-	-
	Caspian Tern	2,3	59	10	16	1.6	12	75.0
	Black Skimmer	3,4	24	10	24	2.4	10	41.6
LM 57A	Great Blue Heron	1,7,9	5	5	16	3.2	12	75.0
	Little Blue Heron	6	-	-	-	-	-	-
	Cattle Egret	5,6,7,9	60	10	33	3.3	25	75.8
	Reddish Egret	10	4	-	-	-	-	-
	Snowy Egret	4,5,6,7,9	25	10	36	3.6	23	63.8

APPENDIX I (Continued)

Island	Species	Colony No.	Total Nests	Nests Monitored	Total Eggs	Average eggs/nest	Eggs Hatched	Hatching Success %
LM 57A (con't)	Louisiana Heron	4,10,11	33	10	22	2.2	18	95.4
	Black-crowned Night Heron	5,9	2	2	-	-	3	-
	White-faced Ibis	4,6,10	150±	10	29	2.9	-	-
	White Ibis	5	3	3	6	2.0	2	-
	Laughing Gull	2,3,8	1000±	10	28	2.8	-	-
	Sooty Tern	10	1	1	1	1.0	-	-
LM 63A	Black Skimmer	1	33	7	20	2.8	5	25.0
LM 81	Great Blue Heron	4	12	3	10	3.3	-	-
	Little Blue Heron	2,4	3	-	-	-	-	-
	Cattle Egret	4	90	10	24	2.4	3	12.5+
	Reddish Egret	2,7	13	10	34	3.4	29	85.3
	Great Egret	4	10	9	21	2.3	14	66.6
	Snowy Egret	4	50	10	29	2.9	18	62.0
	Louisiana Heron	2,3,7	42	8	22	2.7	11	50.0
	White-faced Ibis	3,7	30±	10	37	3.7	19	51.3
	Laughing Gull	6	100±	10	18	1.8	-	-
	Gull-billed Tern	5	29	10	22	1.7	-	-
	Caspian Tern	1	1	1	2	2.0	-	-
	Black Skimmer	1,5	36	10	24	2.4	12	50.0
LM 105	Reddish Egret	4,6	5	5	18	3.6	-	-
	Snowy Egret	3,4	114	10	28	2.8	-	-
	Louisiana Heron	4,6	128	10	27	2.7	-	-
	Black-crowned Night Heron	7	1	1	4	4.0	-	-
	White-faced Ibis	4	41	10	30	3.0	-	-
	Laughing Gull	5,6	47	10	21	2.1	-	-
	Gull-billed Tern	1,2	16	10	15	1.5	-	-
	Black Skimmer	1,2	10	10	28	2.8	-	-
LM 109	Great Blue Heron	3,4,5	79	10	34	3.4	21	61.7
	Cattle Egret	2,3,4,5,6	95	10	30	3.0	-	-
	Reddish Egret	1,7	28	10	39	3.9	-	-
	Snowy Egret	2,3,4,5,6	92	10	32	3.2	27	84.4
	Louisiana Heron	1,7	62	10	28	2.8	-	-
	Laughing Gull	1,7	313	10	24	2.4	-	-
LM 111	Louisiana Heron	3	12	3	32	2.6	15±	46.8
	Laughing Gull	3	25±	10	25	2.5	-	-
	Gull-billed Tern	1,2	3	3	8	2.6	-	-
	Black Skimmer	2	2	2	5	2.5	-	-

APPENDIX I (Continued)

Island	Species	Colony No.	Total Nests	Nests Monitored	Total Eggs	Average eggs/nest	Eggs Hatched	Hatching Success %
GBFC 11-13	Great Egret	2	64	8	22	2.7	15	68.2
	Snowy Egret	2	80	5	14	2.8	7	50.0
	Cattle Egret	2	12	3	7	2.3	4	57.1
	Great Blue Heron	2	12	1	3	3.0	3	100.0
	Louisiana Heron	2	88	6	14	2.6	10	71.4
	Black-crowned Night Heron	3	64	22	60	2.7	41	68.3
	White-faced Ibis	2	30	2	7	2.3	2	28.6
	Roseate Spoonbill	2	35	13	40	3.0	33	82.5
	Laughing Gull	1	1500	160	344	2.1	-	-
HSC 118	Great Egret	1	35	2	6	3.0	3	50.0
	Snowy Egret	1	130	6	17	2.8	7	41.2
	Cattle Egret	1	130	27	78	2.8	13	16.7
	Great Blue Heron	1	1	-	-	-	-	-
	Louisiana Heron	1	38	3	11	3.6	2	18.2
	Black-crowned Night Heron	1	35	3	10	3.3	0	00.0
	Roseate Spoonbill	1	36	9	29	3.2	8	27.6
HSC 90	Olivaceous Cormorant	1	37	-	-	-	-	-
	Great Egret	1	67	3	9	3.0	7	77.7
	Snowy Egret	1	30	7	24	3.4	18	75.0
	Cattle Egret	1	136	16	50	3.1	30	60.0
	Great Blue Heron	1	2	-	-	-	-	-
	Louisiana Heron	1	15	-	.	-	-	-
	Black-crowned Night Heron	1	76	26	78	3.0	60	76.9
	Roseate Spoonbill	1	85	42	127	3.0	100	78.7
HSC 76	Great Egret	1	2	1	2	2.0	2	100.0
	Snowy Egret	1	15	3	9	3.0	9	100.0
	Cattle Egret	1	34	13	38	2.9	33	86.8
	Great Blue Heron	1	4	3	11	3.6	3	27.3
	Reddish Egret	1	2	1	3	3.0	3	100.0
	Louisiana Heron	1	20	8	23	2.8	12	52.2
	Black-crowned Night Heron	1	6	3	9	3.0	5	55.6
	Forster's Tern	2	14	14	24	1.7	0	00.0
HSC 10	Cattle Egret	1	98	17	51	3.0	27	52.9
	Great Blue Heron	1	5	-	-	-	-	-
	Green Heron	1	5	2	5	2.5	3	60.0
	Black-crowned Night Heron	1	19	9	24	2.6	14	58.3
	Black Skimmer	2	43	28	64	2.3	39	60.9
TRC 7	Great Blue Heron	1	1	1	3	3.0	0	00.0
	Green Heron	1	24	22	67	3.0	60	89.6

APPENDIX I (Continued)

Island	Species	Colony No.	Total Nests	Nests Monitored	Total Eggs	Average eggs/nest	Eggs Hatched	Hatching Success %
TRC 2	Olivaceous Cormorant	1	20	8	24	3.0	5	20.8
	Great Egret	1	90	33	88	2.6	17	19.3
	Snowy Egret	1	18	2	7	3.5	2	28.6
	Cattle Egret	1	75	10	31	3.1	8	25.8
	Great Blue Heron	1	14	1	4	4.0	0	00.0
	Louisiana Heron	1	20	2	4	2.0	0	00.0
	Green Heron	1	2	2	6	3.0	0	00.0
	Black-crowned Night Heron	1	18	4	12	3.0	3	25.0
	Roseate Spoonbill	1	32	13	34	2.6	6	17.6
RB 1	Great Egret	1	100	39	113	2.9	97	85.8
	Snowy Egret	1	75	13	41	3.1	30	73.2
	Louisiana Heron	1	69	6	18	3.0	17	94.4
	Black-crowned Night Heron	1	8	1	3	3.0	3	100.0
	Forster's Tern	2	680	11	24	2.1	3	12.5
	Black Skimmer	3	350	44	139	3.1	70	50.4
RB 2	Great Egret	1	6	-	-	-	-	-
	Snowy Egret	1	115	-	-	-	-	-
	Cattle Egret	1	150	-	-	-	-	-
	Louisiana Heron	1	82	-	-	-	-	-
	Black-crowned Night Heron	1	4	-	-	-	-	-
RB 4	Great Egret	1	8	-	-	-	-	-
	Snowy Egret	1	132	-	-	-	-	-
	Cattle Egret	1	50	-	-	-	-	-
	Louisiana Heron	1	112	-	-	-	-	-
	Black-crowned Night Heron	1	13	-	-	-	-	-
WB 52	Great Egret	1	12	8	-	-	-	-
	Snowy Egret	1	30	2	6	3.0	5	83.3
	Reddish Egret	1	12	2	5	2.5	0	00.0
	Louisiana Heron	1	50	10	21	2.1	13	61.9
	Little Blue Heron	1	3	-	-	-	-	-
	Black-crowned Night Heron	1	6	2	-	-	-	-
WB 52A	Snowy Egret	1	15	-	-	-	-	-
	Reddish Egret	1	3	-	-	-	-	-
	Louisiana Heron	1	57	-	-	-	-	-
WB 43	Snowy Egret	1	2	2	-	-	-	-
	Little Blue Heron	1	65	8	19	2.3	11	57.9
	Louisiana Heron	1	2	2	-	-	-	-

APPENDIX I (Concluded)

Island	Species	Colony No.	Total Nests	Nests Monitored	Total Eggs	Average eggs/nest	Eggs Hatched	Hatching Success %
WB 37	Louisiana Heron	2	8	-	-	-	-	-
	Laughing Gull	2	350	17	39	2.3	20	51.2
	Forster's Tern	4	6	6	14	2.3	0	00.0
	Sandwich Tern	3	375	23	23	1.0	18	78.2
	Royal Tern	1	3000	85	87	1.0	69	79.3
	Caspian Tern	1	50	-	-	-	-	-
	Black Skimmer	4	6	6	17	2.8	0	00.0

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Chaney, A H

Use of dredged material islands by colonial seabirds and wading birds in Texas / by A. H. Chaney ... [et al.], Texas A & I University, Kingsville, Texas. Vicksburg, Miss. : U. S. Waterways Experiment Station ; Springfield, Va. : available from National Technical Information Service, 1978.

170, [146] p. : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; D-78-8)

Prepared for Office, Chief of Engineers, U. S. Army, Washington, D. C., under Contract No. DACW39-76-C-1065 (DMRP Work Unit No. 4F01B)

Appendixes D, E, and F on microfiche in pocket.

Literature cited: p. 163-170.

1. Birds. 2. Dredged material. 3. Dredged material disposal. 4. Environmental effects. 5. Habitats. 6. Islands (Landforms). 7. Sampling. 8. Seabirds. 9. Shore birds. 10. Texas coast. 11. Waste disposal sites. I. Texas. A & I University, Kingsville. II. United States. Army. Corps of Engineers. III. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; D-78-8.

TA7.W34 no.D-78-8